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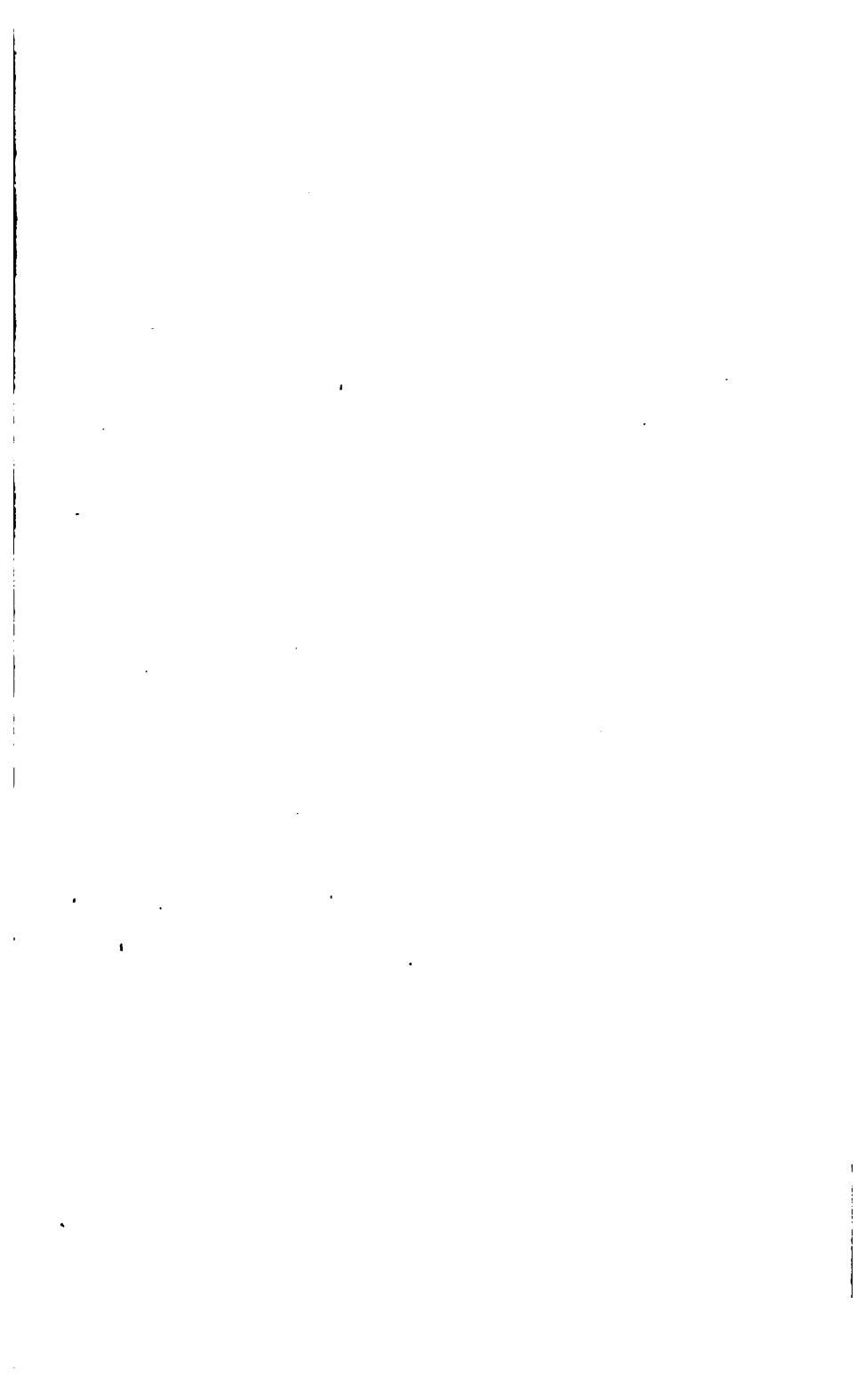
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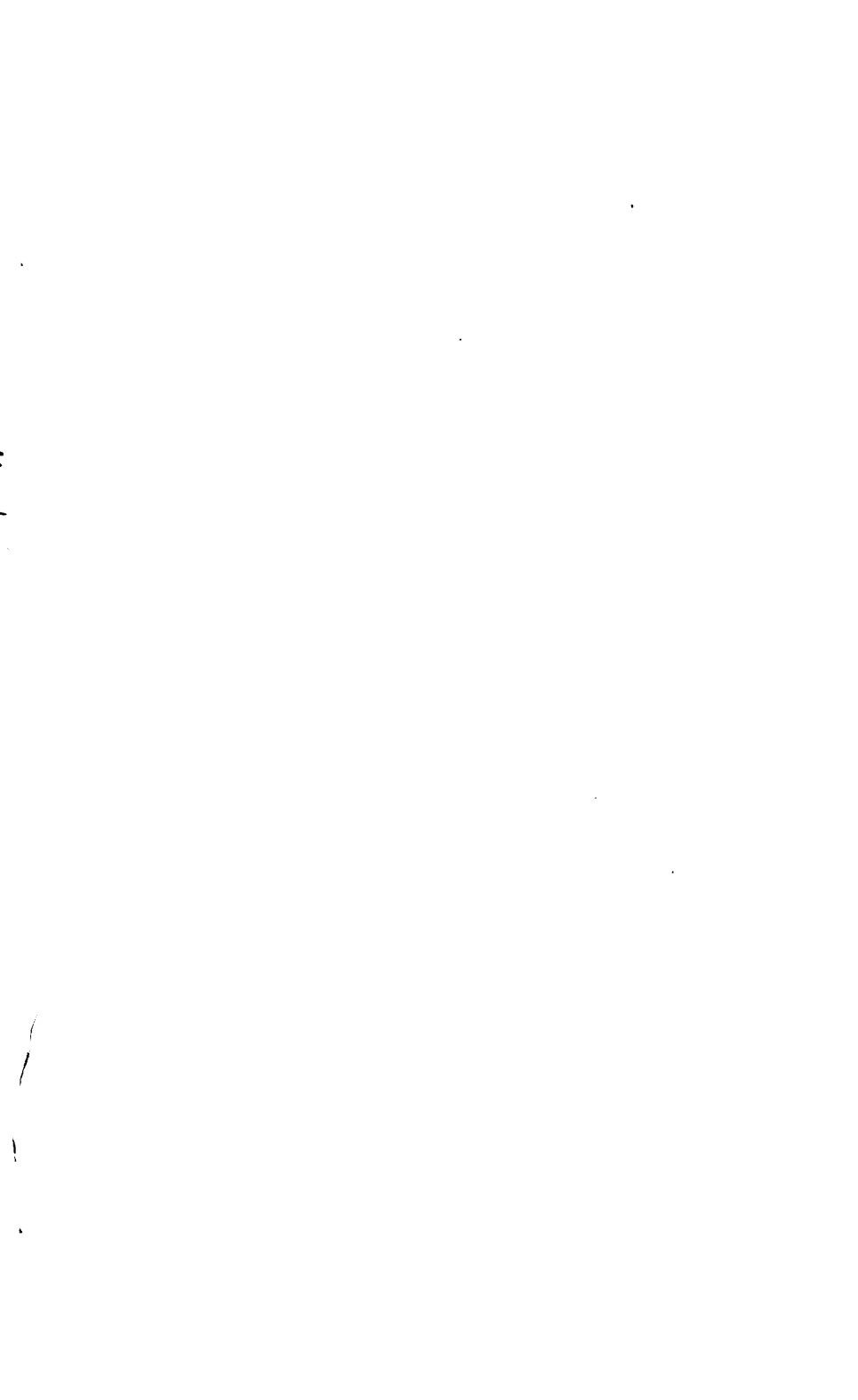
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**JOURNAL**  
**OF THE**  
**ASIATIC SOCIETY OF BENGAL,**

**EDITED BY**  
**THE SECRETARIES.**

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**VOL. XVIII.**

**PART II.—JULY TO DECEMBER, 1849.**

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**"It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science, in different parts of Asia will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish if such communications shall be long intermitted; and it will die away if they shall entirely cease."—SIR WM. JONES.**

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**1850.**



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# JOURNAL

OF THE

## ASIATIC SOCIETY.

JULY, 1849.

*Notices of some Land and Fresh Water Shells occurring in Afghanistan.*—By Capt. THOMAS HUTTON.

The following brief notices refer to the Land and Fresh Water Shells procured during the advance of the Army of the Indus into Afghanistan in 1839. These of course were collected along the line traversed from Dadur in Cutch Gundava, to Girishk on the Helmund,—but it is by no means intended to restrict the Afghan species to the few herein mentioned, for with the exception of the slight attention which my duties occasionally enabled me to pay to the subject, the country was literally unsearched. Some of the species noticed are scarcely determined to my satisfaction, but in the absence of European specimens to compare with them, it was impossible to do more than hazard a conjecture.

Class. 1. Gasteropoda.

Fam HELICIDÆ.

1.—*Parmacellus rutellum*, (Hutton.)

Animal a bright gamboge yellow, with 4 tentacula, posterior portion of the body, behind the shell, carinated; shield strengthened internally with a shovel-shaped shell of a pearly or nacreous appearance; obtuse and globose at the apex, with a deep sinus; covered with a thin transparent epidermis, transversely wrinkled by the lines of growth; colour white; length  $\frac{1}{2}$  inch; breadth about  $\frac{1}{4}$  inch.

No. XXXI.—NEW SERIES.

4 P

Found at Candahar in April, crawling along the sides of damp ditches in the fields; not rare, though apparently local, and only comes out about sunset. It is a true *Parmacellus* of Rang.

2.—*Vitrina baccata* (Hutton).

This very minute species was found under stones, along the bank of a dry nullah or river bed, at a place called Melmandeh, between the Kojuck Pass and Candahar. It appeared to be very scarce, as after a lengthened search only three specimens were found, and of these unfortunately the animals died before an opportunity occurred for examining them.

Shell small, thin, fragile, diaphanous and pale; whorls apparently only one, or at all events the body whorl may be said to constitute the whole shell; aperture nearly circular, lips scarcely interrupted, slightly thickened and partially reflected; surface of the shell polished, finely striated by minute lines of growth, and ornamented with longitudinal bead-like lines or strings of minute bubbles, which can be seen only under a strong lens. Upper side depressed, flattened; under side rounded, ventricose. Length  $1\frac{1}{4}$  lines.

3.—*Helix Candaharica* (Pfr.).

Animal pale straw colour; darkish or dusky on the tentacula; foot not protruding posteriorly beyond the shell, and rather tapering.

Shell much depressed above, orbicular, slightly convex; spire scarcely exerted, whorls 5; colour fuscous or sandy white, ornamented above with a broad longitudinal band of reddish or purplish brown; often breaking into dots where interrupted by the striæ of increase; whorls shining and obliquely striate; aperture ovato-lunate, somewhat oblique; peristome acute, with a thickened rib within the aperture in mature shells; deeply and widely umbilicate, exposing the penultimate whorl and extending nearly to the apex; under side ornamented with narrow dotted or interrupted longitudinal bands of reddish brown, varying much in number from one to six; diameter of largest specimen  $\frac{5}{16}$  of an inch; though the generality do not exceed half an inch.

This is a very variable species in regard to colouring, some individuals having the bands well defined, others having them faint and narrow, and some wanting them altogether, in which case the shell is of a faint fuscescent white with dark apex.



At first sight it bears a strong resemblance to the European *Helix virgata* (Montagu) vel *variabilis* of authors; the broad bands of the coloured individuals, and the colouring of the unbanded ones, being very similar to that shell. It is however readily distinguishable from it by the more flattened form, and by the greater tendency to exhibit bands on the under side; while the umbilicus, being invariably more open and showing a greater portion of the lower whorls, is of itself a sufficiently distinctive character.

In the fields of Lucerne and Clover, as also in gardens and orchards, this snail is very abundant; it appears to have the habit of clustering together when at rest, in great numbers, a singular trait, which is also observable in the *Helix virgata*. In the end of September, I observed them "in coitu," individuals of all colours freely intermixing. The aperture is occasionally closed by a thin viscous plate. Although so extremely common at Candahar, that hundreds might have been collected within a few hours, the species would still appear to be remarkably local, for neither at Quettah on the one hand, nor at Girishk on the other, did I meet with a single specimen.

This shell, discovered by me on the arrival of Shah Shoojah's army at Candahar in the end of April 1839, has been named and described in the Magazine of Natural History, Vol. XVIII. p. 123, by Dr. L. Pfeiffer from specimens in the collection of H. Cuming, Esq. furnished by Mr. Benson, who received them in all probability from myself.

4.—*Helix Bactriana* (Hutton).

Animal straw coloured, with the superior tentacula very long and black; shell carried obliquely horizontal; foot short and rather tapering posteriorly.

Shell fuscous or pale earthy brown, but varying to reddish brown, and in some to sandy; in living specimens dotted over with darker spots or blotches, from the animal being apparent through it; subglobose; spire obtuse, scarcely exerted; whorls 6; aperture ovato-lunate, oblique; whorls obliquely and finely wrinkled with the striae of growth; peristome acute, pillar lip partially reflected over the umbilicus; a strong white rib within the aperture, showing usually a rufous band externally; umbilicus moderate, exposing a portion of the penultimate whorl. Diameter  $\frac{1}{6}$  of an inch. Some have a pale line along the periphery of the body whorl, which is slightly angular.

This is likewise very numerous at Candahar, in gardens and fields, adhering by a thin viscous plate to the stalks of plants; it occurs also abundantly among dead leaves beneath rose bushes, and at the roots of the garden Iris and other plants; sometimes buried in holes in the earth.

It appears to be closely allied to the three British shells, *H. Cantiana* (Montagu), *H. Carthusiana* (Gray), and *H. Rufescens* (Penn), more especially to the latter, which it strongly resembles in colouring, the angularity of the periphery and the blotches of darker colour seen through the shell when the animal is living. In size perhaps it comes nearest the former, as well as in general appearance, but it is less globose in the spire, and the peristome is more reflected.

5.—*Succinea putris*, (Gray.)

There is really nothing to distinguish the Afghan from the European species; the colour, number of whorls, size and shape appear to be quite the same. The animal likewise seems to be in all respects the same. The eyes are situated at the extremity of the superior tentacula, which are cylindrical and buttoned; the second pair diminutive and scarcely apparent; the whole animal is mottled minutely with grey, and several fine grey lines extend backwards from the upper part of the head. It is very common in garden drains, and in marsh lands along the course of the river Helmund at Girishk.

6.—*Succinea Pfeifferi* (Rossm.).

This is apparently another European species, closely allied to, and by some supposed to be only a variety of the foregoing. It has a much shorter spire than the other and the aperture is more elongate.

It occurs plentifully in garden drains at Candahar, but did not appear to mix with the foregoing, and I should be much inclined to regard them as distinct species.

7.—*Pupa lapidaria* (Hutton).

Animal dusky.

Shell composed of 7 cylindrical volutions, exclusive of apex; the three first whorls rapidly decreasing and producing an obtuse spire; the other whorls nearly equal; colour brown; finely wrinkled with oblique strise of growth; aperture ovato-quadrate; lips subreflected, polished and white within; sub-umbilicate; furnished with eight teeth, two on the pillar within, four on the outer lip within, all of which are

visible on the back of the whorl in four pale bands, giving that part a furrowed appearance; and two others on the interrupted part of the peristome, the inner one, which is indeed quite within the aperture, being the largest of all, and the other one small and placed at the angle of the outer lip. Length  $\frac{1}{4}$  inch.

This pretty little species was discovered under stones among blocks of limestone bordering the desert plain of Dusht-i-be-dowlut, at the western end of the Bolan Pass. It is very closely allied to the English species *Pupa Juniperi* (Gray), having the teeth arranged much in the same manner; those of the body whorl giving rise externally to the same furrowed or ribbed appearance. It differs however, in having only seven whorls instead of 8 or 9, and in having the largest tooth placed well within the aperture on the middle of the body whorl.

8.—*Pupa spelæa* (Hutton).

Shell composed of eight convex whorls;  $9\frac{1}{2}$  lines in length, of which nearly one half is occupied by the body whorl; closely and coarsely striated by the lines of increase; polished, nude, ventricose; aperture ovato-quadrate; lips slightly reflected; subumbilicate; spire suddenly tapering; obtuse; colour white with darker dashes; the markings however cannot properly be termed *colours*, since they are in reality only streaks in sculpture, caused by the unequal thickness of the shell, which exhibits alternately an opaque and a semitransparent layer of increase. Pillar lip straight; the outer one bending suddenly in on the body whorl. Found adhering to the inside of fissures and caves at Dusht-i-be-dowlut, and in the Bolan Pass.

9.—*Pupa indica* (Benson's Mss.).

*P. cylindrica* (Hutton), J. A. S. Vol. III. p. 85, No. 6.

This common Indian species, first described and named by me in 1834, runs into three remarkable varieties, differing so much in size and shape that it would not surprise me to find eventually that they are distinct. The name originally bestowed by me has been abandoned in consequence of its being pre-occupied, and Mr. Benson having proposed, from the wide range of the species, to call it *P. Indica*, that name has been adopted. The large variety has 9 to 10 whorls; is cylindriciform and tapers suddenly to an obtuse apex; colour of living shells pale fuscous or earthy, but generally white; whorls closely wrinkled by coarse waving lines of increase; in fresh specimens faintly

scored with obsolete longitudinal furrows; shell nude, polished, thick and opaque. Aperture subquadrate, margins thickened and subreflected; varying from  $\frac{1}{8}$  to  $\frac{1}{4}$  inches in length. Animal dusky; ovo-viviparous. Buries itself in the earth beneath rocks, trees, &c. stopping the aperture with a thin plate of hardened viscous matter.

Var. A.—This is in all respects a perfect miniature of the foregoing, but it seems never to have more than eight whorls, and seldom exceeds  $\frac{1}{4}$  an inch in length; it is far less ventricose, and generally shows the obsolete longitudinal furrows more plainly. This variety occurs both in India and near Quettah in Afghanistan.

Var. B.—With the general sculpture of the last, but shorter, seldom exceeding  $\frac{1}{8}$  of an inch; whorls ventricose and spire more suddenly obtuse than either of the foregoing; with scarcely more than half the length of *P. Indica*, it still rivals it in breadth, and the longitudinal furrows appear to be constant and better defined. Whorls usually seven in number, rarely eight.

The exuviae of all three may be seen in abundance scattered over the sands of the Bhawalpore district.

10.—*Pupa cænopicta*, (Hutton,) J. A. S. Vol. III. p. 85, No. 7.

Animal blackish.

Shell cylindrico-pyramidal, with 6 whorls, minutely striate; body whorl ventricose, the others gradually tapering to an obtuse apex; aperture ovato-lunate; lips subreflected and white within; a single tooth at the junction of the outer lip with the body whorl; colour brown. Length  $\frac{3}{8}$  inches.

In living specimens the shell is often painted over with a coating of mud, which assimilates it so much to the colour of the rocks it inhabits, as to render it difficult of detection. It was discovered by me in 1832 adhering to the face of a bare rock at Bceana near Agra, and again at Neemuch in 1834, adhering to the bricks of a ruined temple. Mr. Benson has likewise taken it beneath stones at Delhi, but in such situations it is destitute of its coating of mud.

It occurred in Afghanistan beneath stones at Dusht-i-be-dowlut.

In the single tooth at the angle of the mouth, it makes an approach to *Pupa umbilicata*, (Gray) of England, but it differs altogether in shape; in being larger, less abruptly obtuse and more tapering.

*Fresh Water Shells.*

## Fam. PALUDINIDÆ.

11.—*Paludina parvula*, (Hutton.)

Animal dusky grey.

Shell conoid, of four whorls exclusive of apex; colour of epidermis dull or dusky green; aperture ovate, rounded below, angular above; oblique; operculum horny; subumbilicate, pillar lip partially reflected; sutures deep; epidermis of the upper whorls usually eroded; transversely striated by fine lines of growth. Length  $\frac{3}{8}$  of an inch, or less.

Inhabits a marshy patch of ground caused by a spring oozing from the side of the Kojuck Pass, at Chummun.

## Fam. LIMNÆIDÆ.

12.—*Limnæa peregra*, (Lam.)

This so closely resembles one of the varieties of the European shell, that I can see no good reason for separating it. On comparing it with an English specimen long since presented to me by Mr. Benson, no character appears to authorize the idea of its being other than a mere variety, and the differences, where any exist, are nothing more than the variations usually observable in a series of specimens. In fact the only difference that I can see, consists in the spire of the Candahar shell being rather more exerted than in the European specimen before me,—but in this respect, judging from Gray's figures and description, there is always great variety, and consequently no importance can be attached to it. At Candahar the species was very common in brick tanks, and almost invariably covered with small aquatic plants or incrustations of lime, concealing the colour, and sometimes even the shape of the shell, a fact which is likewise observable in regard to the European species.

Var. A.—Low down on the Western side of the Kojuck range of hills, at some distance below the Pass, is a green spot called Chummun, from whence issues a small clear spring of water, which spreading over the slope, forms a marshy patch in which are several species of shells, and among them occurs another variety of *Limnæa peregra*, which living in running water is free from the impurities which attach to the Candahar variety, and the substance of the shell is perhaps somewhat thicker.

13.—*Limnæa truncatula* (Gray).*L. fossarius* (Turton).*L. minuta* (Lam).

Animal grey. This is another European species very common on the marsh lands bordering the river Helmund at Girishk, as well as in similar situations at the Kojuck Pass and at Quettah.

In Gray's edition of Turton's British shells, the European shell is stated to be "half an inch long" and to have "six or seven rounded and deeply divided volutions,"—whereas the largest of the Afghan shells does not exceed  $3\frac{1}{2}$  lines, and the whorls are only five in number exclusive of apex. These differences which at first sight might be supposed to indicate distinct species, are however counterbalanced by the fact that the shells of *Limnæa truncatula* are said to be "extremely variable in size and colour, according to the locality in which they are found, and the abundance of their food," and "Mr. Alder observes, that a variety of a much smaller size is found on the margins of rivers, another is found in mountain streams."—(Gray's Turton's British shells).

These latter remarks are strictly applicable to the Afghan shell and leave no doubt as to its being one of the varieties of the European species.

Mr. Benson likewise informed me that he had taken still smaller specimens than mine, in Ireland.

14.—*Limnæa Bactriana* (Hutton).

Animal mottled black and grey.

Shell small, brittle,  $\frac{1}{8}$  of an inch long; spire loosely and obliquely twisted; sutures deep, whorls rounded, aperture ovate long; pillar lip partially reflected; shell closely striate transversely; aperture occupying  $\frac{2}{3}$  of the shell; colour pale greenish brown; whorls 4.

This shell has very much the appearance of the young of *Limnæa chlamys* (Benson), of the gangetic provinces, but the whorls are more rounded, and the spire more horizontally twisted and less awl-shaped. The size however would alone distinguish i., as the largest do not exceed  $\frac{1}{8}$  of an inch, whereas my Scindh specimens of *L. chlamys* are .2 inches. The general size of Indian specimens is about  $1\frac{1}{2}$  inches.

It occurred in marsh lands and streams at Quettah, in Afghanistan.

15.—*Planorbis convexiusculus*, (Hutton.)

Animal black or dusky.

Shell depressed,  $\frac{1}{4}$  of an inch in diameter; pale horn colour; polished; closely and obliquely striate; whorls 4 or 5; rounded; suture well defined; periphery subangular, but not influencing the aperture, which is ovato-lunate; umbilicus wide, discovering all the previous volutions; the whorls rising gradually and spirally from the horizontal, and rounded below.

Occurs plentifully at Candahar in tanks; at Quettah and the Kojuck Pass in marshes, and along the marsh lands of the river Helmund at Girishk.

I have lately ascertained that it likewise occurs in the Gangetic provinces, having taken it from a tank at the foot of a range of hills bordering the grand trunk road, at Tope Chancey. I likewise procured it some years ago from mountain streams at Pinjore below Simla, without then observing the difference, as I find it in my store boxes mixed up with *P. compressus*. It differs from that species in wanting the delicate carina on the periphery, and in having a lunate aperture without the angle on the middle of the outer lip; in being more convex, with rounder whorls: and in having its volutions wound round on a more open and less horizontal twist.\*

Fam. MELANIADÆ.

16.—*Melania elegans*, (Benson.) Gleanings in Science, No. 13 for 1830, p. 22, species C.

This very beautiful species was found in the Bolan Pass at Beebee Nancee, where in April the pebbly bottom of the stream was perfectly alive with them; yet on my return to India two years afterwards in February, not a single shell was visible, all having burrowed deep into the sand in order to escape from the chilling wintry temperature of the mountains.

The largest specimens procured were  $1\frac{2}{8}$  ins. in length, by  $\frac{1}{8}$  ins. wide; shell turreted, gradually tapering to an acute apex; each whorl armed with a row of longitudinally raised ribs, tuberculated at the upper part; epidermis thin, variously coloured, being sometimes fuscous

\* Had I not sent specimens of this shell to Mr. Benson, who pronounced it new, I should from his description have considered it *P. umbilicatis* (Benson) from Sykes.

white, flavescent green, or pale olive green, all being ornamented with purplish or reddish brown flame shaped transverse bands, interrupted and broken into dots by numerous longitudinal furrows, crossed and wrinkled by the lines of growth; in many specimens the whorls bordering the sutures, and the summits of the tubercles are white, which adds greatly to the beauty of the shell; aperture oblique, subovate, longer than broad; operculum horny, and deep brown.

This shell is an inhabitant also of our Indian rivers, and was discovered by Mr. Benson, several years ago. As it was not found beyond Beebe Nanee in the Bolan Pass, it can scarcely be called an Afghan species, though it may serve perhaps to point out the western limits of its geographical range.

17.—*Melania pyramis*, (Benson.) Gleanings in Science, No. 13 for 1830, p. 22, species B.

This common Indian species occurs plentifully at Dadur in Cutch Gundava, and attains a size and beauty equal to any specimens from the Gangetic Provinces. Leaving Dadur and entering the Bolan Pass we again find it mixed up with the foregoing species at Beebe Nanee, but generally of smaller size and less beautiful in the markings. Proceeding onwards we meet with it at Quettah in a clear stream, though of still smaller size than before; this last is that variety of the Indian shell which has a well defined longitudinal reddish brown band along the outside of the columellar or pillar lip. In a marshy and semi-stagnant piece of water at Quettah there is also another variety, large and coarse in sculpture, without markings, and the apex of the spire and epidermis eroded.

As Beebe Nanee appears to be the limit to the range of *M. elegans*, so Quettah would appear to be the limit of *M. pyramis*, as I found no trace of it in the streams farther to the westward.

18.—*Melania tigrina*, (Hutton.)

Shell devoid of apex, the spire being invariably much eroded; general appearance that of *M. pyramis*, but differs in being coarser, in wanting the strong and prominent longitudinal furrows which characterise that species, and which are observable throughout its length; the outer lip also has a tendency to be more produced; while the flame-shaped streaks of colouring are narrower, closer, and less devious or zigzag, often becoming bifid or pronged on the body whorl; epidermis



pale olive green or olive brown, ornamented with close, narrow irregular transverse dashes. General number of whorls in eroded and decollated specimens, five; though nine or ten would appear to be the correct number; wrinkled transversely by coarse lines of increase; the upper angle of the aperture is never so acute as in *M. pyramis*, and the sutures are deeper and whorls more tumid at their junction.

Mr. Benson thought this a mere variety of the preceding shell, the differences being induced by a residence in stagnant waters; this however can scarcely be the case, since in the very same waters, *M. pyramis*, likewise existed, with a full spire and all its other characteristics; even in the uncoloured variety of that species which has the apex partially eroded, the longitudinal furrows and general sculpture of the shell still exist to point out its distinctness.

This species is not peculiar to Afghanistan, having been first discovered by me in 1836 in a garden tank at Pinjore below Simla. Pinjore shells of 5 eroded whorls, measure  $1\frac{1}{2}$  ins. in length, and are finer than Afghan specimens, which do not exceed  $1\frac{1}{2}$  ins., while fully formed individuals of *M. pyramis* from Dadur and the Gangetic Provinces, having 12 whorls, measure no more than  $1\frac{1}{2}$  in. This alone would appear to settle the question of distinctness.

Class 2. *Conchifera*. Lam.

Fam. CYCLADÆ.

19.—*Pisidium paludosum*, (Hutton.)

Shell minute;  $\frac{1}{8}$  of an inch in breadth;  $\frac{1}{10}$  in height; oval; umbones rather blunt; very finely striate transversely; shining dark olive or dusky green.

Inside whitish.

A single specimen only was taken in the swampy ground at Chummun, on the Kojuck range in Afghanistan.

20.—*Corbicula* ——— ?

I refrain from naming this species, which though much larger, appears identical with one of our Indian shells, because I know that Mr. Benson long since showed specimens to Mr. Gray, and it is therefore more than probable that it has been named already, although unknown to me. It is common in canals at Candahar, and attains a size exceeding any I have seen in the Gangetic Provinces, measuring in my finest specimen  $1\frac{3}{8}$  of an inch in breadth, and one inch in height; the

generality however, measure less, being  $1\frac{1}{16}$  in. wide and  $\frac{1}{8}$  in. in height. It is strongly furrowed transversely; with olive brown epidermis and beaks denuded.

Var. A. Also found in the Gangetic Provinces; smaller than the last, being in breadth  $\frac{7}{8}$  in. by  $\frac{1}{8}$  in. high, transversely furrowed; epidermis yellow, or sometimes greenish, half way from the beaks, with a broad yellow border; inside violet or purple, as in the last, of which this may be the young.

Fam. UNIONIDÆ.

21.—*Unio marginalis*, (Lam.)

Shell oval oblong, ventricose, tumid; not produced nor attenuated behind; beaks flattened and denuded; upper edge rounded or falling; lower edge curved; strongly wrinkled transversely; epidermis olive brown; in young specimens with broad yellowish margin. Largest specimen measuring  $1\frac{1}{2}$  in. long, by  $2\frac{1}{8}$  in. broad; another  $1\frac{1}{2}$  in. by  $2\frac{1}{4}$  in.; and a third measures  $1\frac{1}{2}$  in. long, by  $3\frac{1}{16}$  in. wide.

Occurs at Candahar in canals.

Mr. Benson thought this only a strong variety of *U. marginalis* of Lamarck, and in deference to his opinion I have so named it; at the same time I am much inclined to think it distinct, and propose, should it prove so, to call it *U. Candaharicus*. The differences observable appear to consist in the less produced and lengthened form posteriorly, —in the upper part of the anterior edge being straighter and more elevated, than in *U. marginalis*,—and in the beaks being less denuded and more wrinkled.

In *Unio marginalis* of the Gangetic provinces, the breadth appears to exceed the length much more considerably than in the Candahar shells, measuring in four specimens of each as follows:—

1. *Indian specimen*. Length  $1\frac{5}{8}$  in.; breadth  $3\frac{3}{8}$  in.
2. Ditto ditto length  $1\frac{1}{2}$  in.; breadth  $3\frac{1}{2}$  in.
3. Ditto ditto length  $1\frac{5}{8}$  in.; breadth  $3\frac{3}{8}$  in.
4. Ditto ditto length  $1\frac{1}{2}$  in.; breadth 3 in.
1. *Afghan specimen*. Length  $\frac{1}{2}$  in.; breadth  $2\frac{1}{8}$  in.
2. Ditto ditto length  $1\frac{1}{8}$  in.; breadth  $2\frac{1}{4}$  in.
3. Ditto ditto length  $1\frac{1}{8}$  in.; breadth  $2\frac{1}{8}$  in.
4. Ditto ditto length  $1\frac{1}{8}$  in.; breadth  $3\frac{1}{16}$  in.

The proportions thus appear to be reversed,—the Indian species show-

ing a greater transverse breadth in proportion to its length ; the Afghan one showing a greater length in proportion to its breadth. All my specimens of the Indian variety are produced or elongated posteriorly, giving the shell a narrow wedge-shaped appearance ; whereas the Afghan one being transversely shorter appears ovate oblong.

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*Diary of a Trip to Pind Dadud Khan and the Salt Range.*—By ANDREW FLEMING, M. D. Assist. Surgeon 7th N. I. on Deputation to Pind Dadud Khan. (Communicated by Sir H. M. ELLIOT, Sec. Govt. of India.)

*March 9th, 1848.*—*Lahore to Pind de das ka kote, 10 kos.*—Left Lahore this morning, crossed the Ravee and arrived at Pind de das ka kote by 8 A. M., said to be 10 kos from Lahore. A level uninteresting country intervening, in great part uncultivated, except in the proximity of the few wells which are dug, and where crops of a fair appearance are raised. A saline efflorescence of sulphate of soda occurs in great quantity along the whole way, but does not seem to have any injurious effect on the soil, irrigation being apparently all that is required to render it productive of good crops. Four miles from Shah Dera there is a pukka bridge named Pere ka Pool, which spans a nullah, and which is going fast to ruin, but might be repaired at a trifling expense, and would in the rains prove a great comfort to travellers. Within  $\frac{1}{4}$  a mile of Pind de das ka kote is a fine pukka bridge across a nullah called Bagh Binha, down which at present a considerable stream of water is running, and from which a supply of water to irrigate the neighbouring country might be obtained, were means for raising it available. Some zemindars came to complain that Pertaub Sing and followers had been here 4 days before and cut green corn for their horses to the value of Rs. 8, without giving the proprietors any remuneration. Directed injured parties to proceed to Lahore to obtain redress. Supplies obtained in abundance, and water good within 5 or 6 feet of surface.

*March 10th.*—*From Pind de dass ka kote to Santipore, 10 kos.*—From Pind de das ka kote marched to Santipore, a distance said to be 9 kos, but certainly more. Road level, the intervening country being much of the same character as in preceding march, and wells even

scarcer, but where these exist good crops are raised around them. Passed Wudala and Shechem, two considerable sized villages, around which good rich crops of wheat and barley were growing. Around Santipore there is a good deal of kunkur in the soil, which at a little distance from the village is covered with a low dwarf jungle of Caper bushes. Supplies in abundance, water good, though 15 or 20 feet from surface.

*March 11th.—Santipore to Muttoo, 9 kos.*—From Santipore to Muttoo, a distance of 9 kos, the road leads through a level country covered with low bush jungle, in the centre of which however occasional fields of wheat and barley are to be seen, where enterprising individuals have dug wells and cleared away the jungle from their neighbourhood. On the way here passed the villages of Retalee, Vernala and Khan Musselman. Water good though about 23 or 30 feet from surface, and raised by Persian wheels, which seem universal in this part of the country.

*March 12th.—Muttoo to Oodeewalla, 10 kos.*—Marched from Muttoo to Oodeewalla, a distance of 10 kos. General appearance of the country improved, crops being richer, and the fields studded with Babool trees of considerable size. Patches of sugarcane and remains of cotton plantations observed round the villages,—Lulla and Thabul being the only ones of any size near the road. Kunkur exists in considerable quantity around this village, where the water is good about 20 feet from surface, and supplies abundant.

*March 13th.—Oodeewalla to Ramnuggur, 10 or 12 kos.*—From Oodeewalla to Ramnuggur the distance is said to be 10 kos, but is certainly much more. The intervening country, where cultivation does not exist, is covered with a short coarse grass and is quite level. Noewalla and Akalgurh are the only two villages of any size that occur in this march. The latter is a place of some size, several fine gardens existing in its neighbourhood, where the crops are rich and fields well dressed. Kunkur occurs in great quantity around Akalgurh, where the road was completely under water in consequence of recent rain. Three miles beyond this, is Ramnuggur, a town of considerable size. Put up in the Bara-derry, around which some Seikh Artillery are stationed under the command of Col. Lookha Sing, who paid me a visit. There is a salt depôt close to the Bara-derry, where at present 10,000 maunds of salt are accumulated. It is brought on camels from the salt mines, the owners of which receive 4 annas per maund that is deli-

vered at the depôt. It is all weighed previously to being stored up, and is retailed to merchants at Rs. 2-4 per maund. The thanadar and Kardar of this place accompanied me through the depôt and paid me every attention. The Chenab is distant about 2 miles from this place—a flat and in great part uncultivated country intervening.

*March 14th.—Ramnuggur to Phalia, 12 kos.*—From Ramnuggur crossed the Chenab, which is easily effected, the boats being large and in good order, and marched to Phalia, said to be 10 kos, but is certainly more. The Chenab seems to have a considerable depth of water in its channel, but is evidently swollen at present in consequence of recent rains in the hills. On the north bank of the river, and from thence to Phalia, the country is richly cultivated and interspersed with numerous babool and bur trees, which attain a considerable size. On the side of the road are situated the villages of Remmuhl, Pagut, Truka and Kumina. Phalia is a small place, but has a mud fort in its interior. Around it there is a deal of bush jungle, where kunkur occurs in great quantity. At night heavy rain fell and continued falling until 5 A. M.

*March 15th.—Phalia to Phukie, 7 kos.*—Had directed my servants to go on to Hurrin, but in consequence of the rain, they could not proceed farther than Phukie, a march of about 7 kos. The road leads through a thick bush jungle, and so is very heavy in consequence of the rain during the night. Phukie is but a small place—supplies obtained in abundance, but water very bad and brackish, evidently containing a quantity of saline matter. Cultivation to a very small extent exists around this village. Ruttiwall is a village of considerable size on the road to this place.

*March 16th.—Phukie to Hurrin, 6 kos.*—In consequence of rain which fell incessantly from midnight till 8 A. M. was unable to march further than Hurrin, where I found my tent pitched, my servants being unable to get on to Mianee as I had intended. The whole country was under water and the crops completely levelled to the ground in many places. A very dense jungle intervenes between Phukie and Hurrin, where the country is more open and well cultivated, being situated about a mile from the Jhelum, along the banks of which a dense jungle of Tamarisk occurs. The river Jhelum is much flooded and appears a noble river running at the foot of the salt range, which is only about 4 miles from it, a rich wooded Kadir land apparently intervening. Sup-

plies abundant. Complaints made by the sepoys of my Seikh guard that the bunneahs here were using a seer 6 *pie* less in weight than the Company's seer, which is very much lighter than the Lahore one, and which we should suppose is the seer used through the country under the Lahore Government.

*March 17th.—Hurrin.*—Halted here to-day as my tents were still very wet and too heavy for the camels. Jhelum considerably swollen since yesterday and the fields in its neighbourhood perfect swamps. Several very fine poppy fields are growing near this, which are said to yield good opium. Supplies in abundance and water remarkably good.

*March 18th.—Hurrin to Meanee, 7 kos.*—Hurrin to Meanee said to be 7 kos. Towards the Jhelum the country is well cultivated, but to the south of the road until close to Meanee, dense bush jungle covers the country. Several villages occur, the principal of which are Badshapoor, Kirtowall, Chuckdunda, Mulick, Wall, Bula, Chuckseydeda and Kalianpore. On arrival here was waited on by the Kardars, Mulk Doulat Rai and Dass Mull. Around this village poppy fields are pretty numerous and a good deal of opium is said to be made here.

*March 19th.—Meanee to Pind Dadud Khan, cross Jhelum 3 miles.* Crossed the Jhelum this morning and reached Pind Dadud Khan, which is only 3 miles distance from Meanee. The boats on the Jhelum are remarkably large and good, and are propelled across the stream by a large oar, the first we have seen on the Punjanb river boats. The passage of the Jhelum is a very tedious one, from its breadth and the strength of the current. Above Pind Dadud Khan it is divided into two branches that unite into one main stream a little below the towns which is about a mile distant from the river, and situated on a plain of about 4 miles in breadth between the river, and the foot of the salt range, and richly cultivated. Dispatched weekly diary to Lahore and received a visit from Missers Rulla Ram and Gyan Chund, who offered a nuzzur of Rs. 110, which was accepted. The latter shewed me specimens of coal from Keurah, also lumps of iron pyrites from the same place, and specimens of crystallized and compact sulphur from the neighbourhood of Mokudd.

*March 20th.—Pind Dadud Khan.*—Accompanied by Jowhair Mukl, one of the Missers Munshies, I started at daybreak to visit the district where the salt mines of *Keurañ* occur, and where a coal was said to

exist. Distance from Pind Dadud Khan to foot of the hills is about 3 miles, where the road becomes very bad, being covered with loose rounded boulders which have rolled down from the heights above. From the foot of the hills to the salt mine village of Keurah is about 2 miles, through a valley surrounded on each side by rocks of red brick-coloured marl, full of white masses of saccharine gypsum, and resting on a conglomerate of red sandstone. This red marl appears to be the matrix of the rock salt which is found in greatest abundance at *Keurah*, where there are no less than 10 shafts sunk into the marl for the purpose of extracting the article, which is deposited in large quantity around the village as it is brought out of the mine by the workers. The principal shaft at present worked is to the right of the village, the entrance to which is by an opening about 7 feet high cut in the red marl, and leading into a passage which sometimes ascending, at others descending, at last reaches a chamber 30 feet in height, 40 feet long and 640 feet from the mouth of the shaft, and excavated entirely from the rock salt, of which there yet seems abundance, above and below and on either side. In this chamber men, women and children are engaged working the salt by the light of small lamps hung on the walls of the mineral, and their appearance in the dim light is highly striking—their faces and bodies being covered with a saline incrustation. In the bottom of the chamber is a hole filled with brine, said to be of great depth, and to communicate with the other shafts in the neighbourhood. The salt occurs in three varieties—the red, white and glassy, but the former is preferred for culinary purposes, as containing, it is said, less *reshuh*—a term which we presume means “*impurities*.” Although the salt occurs in greatest abundance in the chamber, it is seen all along the passage leading to it, until within 100 feet of the surface, when it becomes mixed with shining masses of crystallized gypsum imbedded in the red marl and which occurs in great quantity in the salt range, both compact and crystalline. In the mine great annoyance is experienced at times by the falling in of the roof and sides of the workings, which might in a great degree be prevented and many lives saved, if proper means were taken to support the roof and sides of the rock from which the salt is extracted, very insufficient means being at present employed, and hence the frequency of accidents. Salt is only extracted from the mines for 8 or 9 months in the year, the danger of working during the rains from

the falling in of the roof of the mines, preventing all operations from being carried on. In the salt mine village of Keurah, there are about 650 inhabitants, 400 of whom are employed in the mines, from which are extracted, according to Misser Gyan Chund, from 48, to 50,000 maunds of salt per annum, at an expense of from Rs. 2, 2-4 to 2-8 per 100 maunds, according to the quality of the salt excavated, and which is sold at Rs. 2 per maund at the mouth of the pit.

Above the red marl containing the salt is a saulpion of conglomerate, sandstone and limestone strata, presenting a steep escarpment to the south and dipping gradually to the N. or N. W. at angles which vary at different points examined. The coal of Keurah is situated about a mile from the salt mine, and to the N. E. and is imbedded in a series of thin laminated sandstones and bituminous shales, charged with aluminous earth and pyrites. The seam is about 2 ft. to 2½ ft. thick, and rests on a blue clay, into which I dug 6 ft. without getting through it. The coal dips to the N. W. with the other strata, and may be traced across a valley for about 30 yards, where it appears to thin out among the blue clay on which it rests. Large samples were obtained of this coal and brought to Pind Dadud Khan. It burns readily to a brown ash, and gives out a powerful heat, but we fear its position in the midst of the hills, which is difficult of access, would render the working of it, *supposing* it to exist in a *regular seam*, a most expensive business. In a limestone in connection with the coal, I detected numerous fragments of fossil shells, a fact of great interest, and which we trust will give a clue to the geological formation in which the coal beds occur, and which we are inclined to consider comparatively recent. The fossils are found at a height certainly not less than 15, or 1600 feet above the level of the sea, 2,100 feet being I think generally given as the height of the salt range. Got back at sunset to my tents at Pind Dadud Khan.

*March 21st.*—Visited again the seam of coal and hills in the neighbourhood of Keurah, but could find no traces of more coal, the seam apparently dipping under the strata forming the range to the N. The coal seems evidently to occur in strata superior to the salt, and hence will probably turn out to be one of those lignites, or irregular deposits, of coal, which in circumstances favorable to their working, have been excavated from time to time at Brora in Sutherlandshire in Scotland, Boney Tracy in



England, and on various parts of the continent, especially along the Rhine. I had the fortune to-day to discover about a dozen species of fossil shells and several other fossils of great interest, of all which and of the strata of the range a collection has been made. In the shales containing the coal a quantity of a luminous earth and iron pyrites exists, from which the alum of commerce could be obtained. Crystals of sulphate of magnesia were found in connection with the alum shales and specimens preserved. Returned to Pind Dadud Khan at sunset.

*March 22nd.—Pind Dadud Khan.*—Received visits from Missers Rula Ram and Gyan Chand, who have yielded me every assistance in their power in the prosecution of my investigation of the range of hills. Visited the mint here, which is under the superintendence of the former. Silver is collected in all directions in the shape of old rupees, bangles and silver ornaments, which after being refined are converted into the new Lahore Rupee. At present the silver from which rupees are being manufactured, are Mahmoud Shah Rupees from the Hazara and countries to the north, and of the value of about 12 annas. These contain copper and lead, which is separated from them previous to their being converted into the new rupees. This is effected by the process of cupellation, and which is performed in a very simple but effective way. A hole is dug in the earth according to the size of the cupel to be made, into this hole a quantity of wood ashes is thrown, moistened with water and wrought up into a saucer-shaped vessel, its sides projecting above the level of the ground. On these are placed two pieces of fire clay so as to increase the depth of the cupel and encircle its mouth, except for about 3 inches at one side, in which is inserted the mouth of a tube connected with a mussuck to act as a bellows. This apparatus being prepared, the cupel is filled with charcoal, on which after it is ignited the silver to be refined is thrown, and in the case of the Mahmoud Shah Rupees, an equal weight of lead is thrown in along with them so as during its oxidation to carry all the copper into the substance of the cupel, and leave the pure silver behind. The experiment we saw performed was on Rs. 1000, and the operation was finished in two hours, during which time an intense heat was kept up by the bellows. The lead and copper are afterwards extracted from the cupel by ordinary means, and contain a little silver, probably in conse-

quence of the quantity of lead used being in excess of the proper proportion to the amount of copper contained in the assay.

The silver being obtained of sufficient purity to constitute the new rupees, which are *said to be pure silver*, it is cut into bars about the breadth of a rupee and handed over to an artificer, who cuts these into the necessary weights to constitute the rupees. This being done, the rough bits of silver are heated to redness on hot charcoal, and when hot are beaten on an anvil with a round-headed hammer into the shape and size of the standard rupee. In this state they are handed over to a man who finishes them by impressing the necessary inscription, which is done on a *die* of a most simple description, being an anvil with a round and highly tempered steel surface, on which the inscription is engraved in reverse. On this the rupee is placed, and on it a punch with a round and highly tempered steel face, on which the inscription to be impressed on the upper side of the rupee is carved. The punch being applied to the rupee, a smart blow from a heavy hammer is given by a man who stands in front of the one in charge of the die, and who holds the punch in his left hand and a handful of *raw* rupees in his right, the lower die being firmly fixed in a strong case. In this way 40 rupees were passed through the die well engraved, in one minute, and the artificer said that on an average he could engrave 1500 per hour. From 1000 Mahmoud Shah rupees, 750 new Lahore rupees are manufactured.

*March 23rd.—Pind Dadud Khan.*—Left Pind Dadud Khan at sunrise for the purpose of visiting a point of the salt range to the W. of Keurah, and to the N. W. of the former town, where the range seemed to attain a great height, the fort of Dundhote being built on it. The ascent being very difficult and rocky, was obliged to leave my horse behind and go on foot to climb the hills. As before, the lower part of the range at this point is formed of the saliferous red marl, but at present is not excavated for salt. Above this is a succession of sandstones and conglomerates, almost destitute of vegetation on their surface and dipping to the N. W. at a considerable angle. Superimposed upon these and a considerable distance below the fort of Dundhote, there occurs a series of fossil sandstones and bituminous shales, among which a seam of coal 2 *ft. thick* is found, in every character appearing the same as the one described as occurring at Keurah, 2 or 3 miles distant. It

does not however appear of so good a quality, but from its position in the heart of the hills, where no beast of burden could at present reach it, can never be worked to advantage. In relation to it I met with the same limestone as at Keurah, and obtained several fossils in addition to those I got at the latter place, among which was an *Echinus*, and a species of coral, besides several species of shells. Above the coal shales is a succession of calcareous sandstones, generally of light red color, and resting on these is a bold escarpment of a limestone rock, apparently siliceous and containing large numbers of flints such as are found in the English chalk formation. From the strata below this the water that issues is perfect brine, while from the limestone the water flows sweet and good, and is most refreshing to any one who attempts to climb such hills. I reached the top of the range at the fort of Dundhote about 3 p. m., and was quite taken by surprise by finding on the gentle northern slope of the limestone strata, which we are inclined to identify with the chalk formation, a beautiful garden in the midst of a comparative desert—crops of wheat, barley, &c. being in full growth on the soil formed by the decomposition of the limestone. This fort seems to be placed on one of the highest points of the range, and commands a most extensive view. It is said to be within 4 miles of *Kutas*, and from it *Choe*, a fortress in the hills, is well seen. After resting a little, began the descent of the hills, which from the rough road was almost as difficult as the ascent, and reached my tents at Pind Dadud Khan about dark, pretty well knocked up with my day's work, which however well repaid me for the labour of the ascent.

*March 24th.—Pind Dadud Khan.*—Received visits from Missers Gyan Chund and Rulla Ram, and dispatched diary to Lahore. Again visited the Mint to witness the process employed for the revival of the lead, copper and small portion of silver absorbed by the cupel alluded to in diary of 22nd, but which presented nothing uncommon; a mixture of *Sujee* (Carbonate of Soda), and Borax being used to reduce the oxidized metals to a metallic state. *Sujee*, a coarse Carbonate of Soda, is manufactured near this in quantity by burning a Chenopodeaceous plant, probably allied to *Salsola*, from the ashes of which it is obtained. This occurs in great quantity wherever the soil is impregnated with salt, as is the case in the plains at the foot of the salt range.

*March 25th.—Pind Dadud Khan, to Ruttipind.*—Visited the vil-

lage of Tober, where during the rains, on account of the heat and mosquitoes, the inhabitants of the salt mine village of Keurah are obliged to take refuge, completely deserting the latter. It is situated at a considerable height above the salt mine to the west of the road to Kutass, and is built on the sandstone strata which rest on the saliferous red marl. The access to it is by a narrow footpath cut out of the rocks, the ascent of which is very steep. The huts of the village are all built of stone, cemented with mud and are flat-roofed. Beyond this village are a succession of heights rising one above the other of sandstones and conglomerates, the former at times highly calcareous and dipping to the N. at an angle of  $35^{\circ}$  or  $40^{\circ}$ . Ascending towards the white cliffs above the village of Ruttipind or Goomrali, one comes on a series of friable white and yellow calcareous sandstones of a coarse kind, succeeded by a series of dark-coloured bituminous shales full of gypsum and pyrites and interlaminated with thin beds of a yellow clay. These shales are from 30 to 35 feet thick, and inclosed in them I discovered two seams of coal, the lower 2 ft. thick and separated from the upper, which is 4 ft. thick by about a foot of shales. Both seams were traced down a valley for 50 or 60 yards, but the coal does not appear so good as that of Keurah, being more brittle and containing a good deal of clay. Above the shales is a yellow marl containing a few shells; and superimposed on this the same limestone containing abundance of fossils as found at Keurah, Dundhota, &c. Covering this is the white siliceous limestone full of flints. It contains fossils, and forms the summit of the hills of the range. On reaching the top of these a series of valleys running east and west is presented to view, yielding good crops and abundance of sweet water, and forming a striking contrast to the southern aspect of the salt range. Close to the village of Ruttipind there is a large *kutch*a tank of water. In the afternoon got back to Keurah and visited another salt mine about  $\frac{1}{2}$  mile distant, called *Lugowalla*. This mine yields a very large quantity of salt of the best quality, and is very easily worked. The entrance to it is at a considerable height on the side of a hill, and the descent into the mine is by a series of steps. The salt is close to the surface, and in the interior of the mine enormous masses of salt are lying which have become detached from its roof and sides, and under which the various passages lead to an immense distance. The temperature of this mine was much lower than the Keurah one,

but having through an accident broken my thermometer was unable to ascertain it exactly. There is a good deal of moisture in the mine, and probably to this cause may be assigned its comparative coolness. The salt appears quite inexhaustible, and to be deposited in strata with their partings of red marl, and dipping to the N. at an angle of  $35^{\circ}$  or  $40^{\circ}$ . The roof of the mine is here and there rent and cracked in an extraordinary way, and is incrustated with a salt efflorescence as well as with stalactites of salt, which with the dim light in which they are seen, present a most striking appearance. Some of these were upwards of a foot in length and much resembled the stalactites of carbonate of lime so often seen under bridges or in caves. Goolab Sing is the last individual who has visited this mine from curiosity, which is considered rather unsafe from the loose state of the rocks forming its roof and sides. It is however by far the most wonderful of the mines in the neighbourhood. Got back to Pind Dadud Khan late in the evening.

*March 27th.—Pind Dadud Khan to Baghanwalla, 10 kos.*—Left Pind Dadud Khan this morning and marched to Baghanwalla, a distance of fully 10 kos, to the east of the former town, the road leading through a well cultivated plain running parallel to the salt range. Within about 2 miles of Baghanwalla the road becomes very stony and bad, and the soil in its neighbourhood studded with bushes of *Salvadora*, *Capparis*, *Aphylla*, *Asclepias gigantia*, *Zizyphus*, &c. &c. which reach up to the very foot of the range. When these have been removed good crops of barley are raised, water being abundant for the purpose of irrigation. The village is situated at the foot of a valley, and is built on the sandstone forming the base of the hills. No salt is got here, although the ground is in many places incrustated with a salt efflorescence, and the red gypsum marl prevails, but not nearly to the extent that it does to the east. The comparative absence of salt in the rocks around the place is evinced by the much greater amount of vegetation prevailing on their surface, which in many places is covered with trees of small size, so as to give a green appearance. In the afternoon visited some of the heights to the east of the village, but saw no traces of coal or other minerals of importance. The red saliferous marl is succeeded by a series of bluish grey soft argillaceous fissile sandstones dipping to the N. N. W. at a considerable angle, and on which rests a blue calcareous sandstone. Above this is a fawn colored siliceous fine grained lime-

stone of considerable thickness, on which rests a series of variegated sandstones enclosing nodules of a greenish clay. The prevailing color of these strata is blood red, and on their northern slopes, which form a succession of valleys, vegetation seems to thrive. We here found a species of *Nerium* growing on the banks of the rivulets, a *Scrophularia*, a *Viola*? and several other interesting plants. In the clear stream which runs through the village of Baghanwalla, there are numerous small fish of a species of *Salmon*? *Cyprinus* and *Cobitis*? none of them however longer than 6 inches; a species of crab is also frequently to be seen in the fresh water streams of the range, and even close to its summit.

*28th March.—Baghanwalla.*—Visited the coal seam which occurs in a small valley about 3 miles N. E. from this, in the middle of the hills, which from the neighbourhood of Baghanwalla to the point where the coal is seen, are of a blood red color, from the sandstone rocks on their surface. The coal, as in the other localities where the mineral is found in this neighbourhood, is associated with a marl, bituminous shales and limestones full of fossils, and in this locality these occur in the succession mentioned, resting on the variegated sandstones constituting the middle part of the hills. The coal seam is included in a yellow calcareous marl and is in some places 5 ft. in thickness. Above the marl, and within a foot of the coal, the limestone is full of shells, indeed it appears to be composed of them; and on it is a stratum of chalk limestone, which seems the representative of the siliceous flinty limestone which in other points of the range is so largely developed. The coal seam can be traced on each side of the valley where it is best seen, for at least  $\frac{1}{2}$  a mile, in some places appearing to degenerate into highly bituminous shales, and in others to form really good coal, the best and thickest part of the seam being in the valley above mentioned. The seam dips conformably with the strata above and below to the N. N. W. at an angle of  $45^{\circ}$  to  $50^{\circ}$ ; and from its general appearance and the geological character of the rocks and fossils with which it is associated, appears to us to be, if not the same, at least one much resembling the seams at Keurah, Dundhote and Ruttipind, and differing from these apparently in their being a less development of bituminous shales, their place being supplied by the lignite seam, which in some places includes brown masses of half decomposed vegetable matter. Above the carboniferous

strata is imposed a grey friable sandstone, which is succeeded by a series of strata forming a range of low hills running N. N. E. towards Doo-meyala, and between the village of Futtipoor and mount Tillah. These strata appear to be a succession of soft sandstones of a red and blue color, and appear to dip towards mount Tillah, which is about 20 miles distant. In the coal large masses of sienite or crystallized gypsum are found imbedded, and in the shales large quantities of iron pyrites. Good samples of the coal were taken, which from its position in the heart of the hills, and from the high inclination of the strata could only be worked at a large expense. In the hills around Baghanwalla, I on two occasions saw an animal known to the natives by the name of *Ouriar*. Once only had I an opportunity of approaching them; unfortunately I had not my gun with me. They roam about in flocks of 6 or 8, the female resembles a small female antelope, but is of stouter make and of a dark brown color. The male is much larger, has the body of a deer, but the head resembles that of a ram. In the individual we saw, the horns were large and curved backwards on the head. He was of a dark brown color and had a streak of long black coarse hair extending from his chin to his breast. They are very wary and but seldom allow people to approach. Porcupines are frequently seen, and leopards are by no means uncommon.

*March 29th.—Baghanwalla.*—Being anxious to trace the fossiliferous limestone above the coal to the W. of the position where that mineral is best seen, I crossed the highest part of the range of hills behind Baghanwalla, when I came upon the flinty siliceous sandstone, and traced this gradually to the east, until it was covered by apparently a series of sandstone strata forming the low range of hills stretching towards Mt. Doomwala, and through which the small stream, the *Bunnah*, flows, in whose sand gold is collected in small quantity. The fossiliferous limestone is in some places well seen, as also the marl, including the bituminous shales, in which the coal occurs, but owing to the immense quantities of loose stones which have rolled down from the heights, no good sections of the coal seam could be got until within about a mile of the valley before mentioned, where it occurs of best quality and most largely developed. In the neighbourhood of Baghanwalla the following appears to be the order of succession of the rocks composing the range commencing at the base.

1. A compact red sandstone, on which rests
2. The red saliferous marl containing large masses of gypsum, both saccharine and crystallized, and covered with a saline incrustation.
3. A series of red and brown sandstones of various thickness and fineness, with here and there conglomerates.
4. A series of blue slaty soft argillaceous sandstones of considerable thickness, and towards their upper part becoming calcareous, so as to form a bad sort of limestone of a bluish colour.
5. A light fawn-colored limestone of a siliceous character, and devoid of fossils.
6. A thick series of dark blood red sandstones and fine conglomerates, containing nodules of a greenish clay, and interlaminated with thin strata of clay of a blue color. In the sandstones vegetable impressions resembling the fronds of Fuci were noticed, and also ripple marks, but no other fossils.
7. Yellow marl.
8. Bituminous shales with coal.
9. Marl and shell limestone running into a cherty limestone, containing bodies resembling nummulites, and minute shells.
10. Sandstones of a blue and red color stretching to the N. E. and interlaminated apparently with strata of blue clay. These sandstones are only noticed towards the east of Baghanwalla, and seem deficient on the western part of the range.

N. B. *Sungi Momiai* is the local name of coal in this district, and is used extensively by the hakims as a medicine, administered internally along with milk, in all bruises, wounds or external injuries, and it is said with wonderful effect.

*Gypsum*, known here by the name of *Aberuck*, is not used for any purpose, the natives being ignorant of its properties when calcined.

*March 30th.*—Returned to Pind Dadud Khan, passing on the way the villages of Gureebwalla, Tudial, Riwal and Kusseli. A practice prevails among the zemindars of this district of ploughing up the paths which exist between the villages, which proves a source of great annoyance to travellers, there being in some places no road or path left. In the evening received visits from the two Missers, who communicated the intelligence of Mool Raj's resignation of office and of Mr. Agnew being about to be sent to Mooltan along with Shem Shere Sing. Left specimens of Baghanwalla coal with Misser Gyan Chund.



*March 31st.—Pind Dadud Khan to Choe, 8 kos.*—Crossed the salt range to Choe. On the southern slope of the range the road is most execrable, but on reaching the ridge or highest point at Dundhote, it somewhat improves—the ascents and descents being of less height, and several well cultivated valleys intervening. From Dundhote to Choe the strata seem entirely composed of a siliceous flinty limestone, which by atmospheric influence disintegrates into round boulders, which strew the face of the hills and valleys and render the road very bad for horses or camels. As the traffic between the south and north sides of the range at this point is considerable, it is much to be desired that a road were made on which loaded camels could travel with ease,—a project which we should think could be effected without any great difficulty or expense, from the soft character of the rocks, on the south side in particular, where a good road is most required in consequence of the ascent being greatest. All along the southern slope of the range sweet water is abundant, and at Choe a clear running stream commences and continues its course to the famous tank at Kutass. To the N. W. of Choe, about 2 miles, is a hill of considerable height called Kuringuli, on the top of which, in a limestone rock, grains or rather small cubical crystals of *Sulphuret of Antimony*?\* are found, which is considered of very fine quality, and sells at a higher price here than that brought from the northern countries. Kuringuli appears to be based upon the same flinty limestone as extends from Dundhote to Choe, but above it are a series of calcareous sandstones, conglomerates and sandstones of a brownish colour, on which reposes the arenaceous limestone containing the Surma, all these strata appearing to dip towards the plain of Dunni to the N. The Surma occurs in but small quantity and is collected chiefly after rain by the villagers, who find it in the channels made by the water running down the ravines. At the very top of the hill, on its south western escarpment, there seems to have existed a small vein of it, a sort of cave having been excavated in the limestone rock, down the face of which the villagers descend by means of a rope to search for the mineral, in which attempts, two individuals have lost their lives in consequence of the cutting of the rope, by which they had suspended themselves, they having fallen into the valley below, a height of at least 200 feet. From the western side of

\* Sulphuret of Lead, or Galena. (See Report.)

Kuringuli a series of sandstone strata are seen stretching to the W. forming as it were a natural boundary between the Illaquis of Chungur and Thunni. These strata, as seen from the top of Kuringuli, appear to dip to the N. W. under the plain of Thunni, and rest on the strata forming that hill, being in appearance exactly similar to those seen at Baghanwalla, as stretching towards Mount Doomeyala, and evidently of a more recent character than the strata on which they repose.

*April 1st.—Choe to Kutass, 4 kos.*—From Choe came unto Kutass this morning, the road leading through a series of valleys surrounded by limestone hills, through which the clear stream of water flows towards Kutass, which commences at Choe and on the sides of which a fine green sward exists. Around Kutass the limestone hills in some places are covered with a recent kind of limestone commonly known under the name of Travertine, and which when burned yields a remarkably white and fine lime, a property of which the natives of this place are well aware, and for which they quarry it extensively. The same *Travertine* is seen at Dundhote, Baghanwalla, &c. resting on the siliceous flint limestone, and frequently contains perfect impressions of leaves, &c. on which the lime forming the recent rock, has been deposited from water, originally holding it in solution.

The difference in the character of the rocks on the north and south sides of the salt range, gives to the vegetation an equally different appearance. On the south side, and where the *salt rocks* occur, the soil is barren in the extreme, but whenever one gets above their influence trees and shrubs occur, giving a green appearance to the sides of the hills in the valleys, between which, especially on the north side of the range, good crops of barley and wheat are raised. At Kutass the famous tank of water is formed in a fissure of the flinty limestone rock, and is said by the natives to be of such a depth that though a faqueer spent two years in making a rope, he could not in that time make it long enough to reach to the bottom of the tank,—a fact, the value of which only depends upon the length of rope he *really* manufactured, information on which point I could not obtain. Being anxious to ascertain if the alledged depth was really correct, I procured a rope about 300 yards long, to which a heavy weight was attached, and entrusting it to a man seated on a charpoy supported by inverted gurras, by navigating which on the surface of the tank, I obtained the depths at

several hundred points, but in no case found it greater than 23 feet, a fact which we think disproves its alledged depth, although we have no doubt that a small fissure exists in the bottom of the tank in the limestone rock, by which the superfluous water is carried off to a lower level, there being no apparent exit for the water flowing into it. At present there is an immense concourse of people at this place, which from its beautiful position in the heart of the hills, is well chosen as a residence for faqueers.

*April 2nd.—Kutass.*—Despatched diary to Lahore, and being Sunday halted.

*April 3rd.—Kutass to Kuhar, 10 kos.*—Came unto Kuhar this morning, a distance of about 10 kos. The road leads through a series of valleys between a lower range of hills and about 3 or 4 miles from the high ridge of the range. Towards Kuhar the flinty limestone is here and there capped by calcareous sandstone and conglomerates, which to the north become more and more abundant. Kuhar is situated to the W. of a salt water lake in a valley surrounded by hills composed of strata far superior to those yielding salt, which is excavated about 3 miles south from Kuhar at a village called Surdi. This lake is probably identical with the salt lake of the same name laid down in Tassin's map to the south of the salt range. Its water is a perfect brine, but whence the salt is derived could not be ascertained. To the west of the lake the water is sweet and good and in great abundance, issuing from the limestone rock in a clear stream behind the village of Kuhar, and flowing towards the west, a very small portion of it running into the lake; at the eastern extremity of which a small burn which drains a valley near the salt depôt, and which at the time we passed it was nearly dry, appears to enter. The banks of the lake are covered with a saline incrustation, but I could get no information as to whether salt was deposited from the waters in the lake by evaporation, which must be the case if salt springs still continue to flow into it, a fact which we could not ascertain.

The surface of the lake is covered with wild fowl which collect in great quantity wherever the smallest stream of fresh water enters, and in the neighbourhood of which their food is probably found. We could not learn that any fish existed in the lake, the banks of which are formed of a soft foeted blue mud covered with a thin sward. Fevers

are prevalent at Kuhar, and no doubt are the result of the malarious exhalation of the lake. As coal was said to occur to the north of Kuhar, I visited the locality at a place called Narwa, where a clear stream has cut its way to the depth of at least 200 ft. through a series of soft friable sandstones of a greyish colour, interlaminated with beds of red and blue indurated clays, all of which dip to N. N. W. at an angle of  $25^{\circ}$ , and seem from their general appearance to be identical with those which abut on Kuringuli and stretch west between the Illaguas of Thunni and Kuhoong, their lower strata resting on the flinty limestone which forms the ridge of the salt range. At the bottom of the valley above mentioned and nearly on a level with the stream, *masses* of coal of a totally different character from any hitherto seen make their appearance, but in *no regular seam*, being evidently the remains of trunks of trees which in these strata have become converted into coal of the character of *Jet*, and in which in some specimens the fibrous character of the altered wood is most distinctly seen. This coal occurs in the soft friable grey sandstone, and near it I found distinct marks of leaves in the sandstone (probably those of a palm), destitute however of coaly matter. No other organisms could be found associated with the coal, but in an indurated blue clay above the sandstone indistinct marks of these were observed. The strata above mentioned seem evidently of a more recent character than those to the south, and appear to dip under the plain of the Illaqua of Thunni. On the tops of the hills formed by these strata large deposits of travertine occur of the same character as described at Kuhar, &c.

P. S. Can the small fresh water rivulet which forms the valley of Nurwa be the drainage of the tank at Kutass?

*April 4th.—Kuhar to the salt mines of Surdi.*—Left Kuhar this morning for the purpose of visiting the salt mines of Surdi on the south face of the salt range, and within a couple of miles of the plain of Jhelum. From Kuhar to the salt mine village of Surdi, a distance of fully 6 miles, the road gradually ascends through a series of cultivated valleys between hills, covered with bushes of an Acanthaceous shrub, probably a species of *Hypoestes*, which abounds on the salt range ground and affords a good shelter to Chicore and Pheasants, the former of which are at this point very abundant. These hills are apparently composed of a continuation of the same series of strata as seen to the

N. of Kuhar, beneath which are a succession of conglomerates of a calcareous character, interlaminated with a limestone much resembling that of Kuringuli where the Surma occurs. Beneath these strata and as one approaches the highest ridge of the range at Surdi, the flint limestone crops out and forms the top of its bold southern escarpment, being deposited in a stratum at least 200 ft. thick, on the northern slope of which is a very richly cultivated valley stretching E. and W. On descending from Surdi the same shell limestone and marl as is found above the coal to the eastward was seen beneath the flint limestone, but the position of the carboniferous strata was completely obscured by the enormous masses of rock which have fallen from the disintegrating limestone above, and which are accumulated between this and the variegated sandstone strata beneath the coal-beds. We are satisfied the same lignite bed occurs here as to the east, and if diligent search were made in the neighbourhood I believe it would be found, although we were unsuccessful, being unable on account of the intense heat to search at various points as we could have wished.

The salt mines of Surdi, three of which I visited, have been more recently opened than those to the east, and appear to be constructed on a better plan; good flights of steps being cut out of the salt to facilitate the ascent and descent of the mine, and the roof of the passages being well supported by cross beams of wood. The salt appears of excellent quality, close to the surface and remarkably compact. These mines are under the management of Peer Mohumodeen, who stated that 40,000 maunds of salt were annually extracted from the mines at this place, and which is sent chiefly to Kashmír and the north.\* The salt as it is raised from the mine is conveyed on camels to a depôt about 2 miles from Kuhar on the road to Kutass, none of it being sent to the south side of the range.

*April 5th.—Kuhar to Noorpoor Suhutta, 9 kos.*—From Kuhar came on this morning to Noorpoor Suhutta. The road skirts along the foot of the flinty limestone hills and through valleys generally well cultivated, but which seem to be but scantily supplied with water. Noorpoor is nearly S. W. from Kuhar, and situated more on the ridge of the range than the latter place. Around it there is rich cultivation,

\* We are inclined to doubt the accuracy of the amount of salt excavated here as stated above.

water being abundant within 8 feet of surface. The flint limestone generally prevails here, being at times capped by the soft friable sandstones and conglomerates which form the lower part of the northern slope of the salt range.

*April 6th.—Noorpoor and Nilawan coal.*—A little to the south of Noorpoor, and above the Nilawan salt mines, the flint limestone forms a precipice at least 150 feet high, beneath which is the same shell limestone as is found in other localities to the E. above the coal beds, and only differs at this point in being more arenaceous. Beneath the shell limestone is the yellow marl, succeeded by bituminous shales at least 30 feet thick, in which two small seams of coal occur 8 inches in thickness and separated from each other by about a foot of shales. The coal is identical in character with that to the eastward, and the carboniferous strata at this point seem only to differ from those to the east in their being a less deposit of coal and a greater development of bituminous shales. Beneath the coal is the usual succession of sandstones, conglomerates, &c. reposing on the red saliferous marls of the Nilawan salt mines, at present closed. Samples of this coal were preserved and sent along with a specimen of the Kuhar Jet coal to the care of Misser Gyan Chund at Pind Dadud Khan, to await my return to that place.

*April 7th.—Noorpoor to Jabba, 10 kos.*—From Noorpoor came on to Jabba, a distance of 10 kos, passing the villages of Monara, Pudral and Pyle—near the latter place, the plain of the Jhelum is distinctly seen, and at this point there is a sort of valley across the salt range, through which a good camel road is said to exist leading to the village of Kutta on the south side of the range. From Noorpoor to Pyle the road is very rough, leading along hills of the flinty limestone, but from Pyle to Jabba the direction is northerly, and the sandstone strata appears forming a more level country than to the south. At Jabba the water is near the surface, and raised from wells sunk about 6 feet in the ground. To the north of the place the strata seem altogether composed of soft friable sandstones, conglomerates and clays, which dip at a very small angle towards the plain of the Illaqua of Chingee, and which are part of the same series as rest on the flinty limestone towards the ridge of the range, and are evidently of a much more recent character. They seem to be comparatively destitute of organic remains, although nodules of peroxide of iron are abundant in them, and which has probably been accumulated around a centre of some organic matter.

*April 8th.—Jabba to Tillah, 14 kos.*—Being informed there was no road for camels along the first N. slope of the range, marched to Tillah, which is nearly due north from Jabba. Between these places soft grey sandstones and conglomerates, interlaminated with beds of reddish clay, occur, by the desintegration of which a soil is formed which is tolerably productive in the neighbourhood of wells, these being however very scarce to the S. of Tillah, but increasing in number as one descends to that place, which is situated on the N. bank of a dry nullah of considerable size, from the sands of which gold is regularly washed. At a village called Nukha, about 3 miles E. of Tillah, gold is found in considerable abundance in a nullah which flows through a valley enclosed on each side by soft sandstone, in which the gold occurs. The Gambir is the name of the nullah, and washing its sands; about 150 men are constantly employed; a part of the nullah having been fixed upon for the operation, the superficial stratum of sand is removed, and that beneath collected with a wooden shovel and carried to the spot where it is to be washed—generally close at hand. The washing is effected in a long wooden box, resembling a small flat-bottomed boat, wide at one end and narrow at the other, where there is an opening. The wide end of this box or *Troon*, as it is called, is slightly elevated, so as to give its flat bottom a gentle inclination towards its forepart, and a coarse sieve of Sirkee or twigs of wood is then placed on the wide end of the box. On this, portions of sand are from time to time thrown, a stream of water being dashed upon them, by which means the fine sand is washed into the troon, the coarse gravel being retained on the sieve. By continuing the washing, the lighter particles of the sand are carried down the inclined bottom of the troon and escape at the opening in its forepart, while the heavier and auriferous sand assumes the highest level next the point where the stream of water is applied. In a very short time nothing remains in the bottom of the troon but a thin stratum of black magnetic iron sand, by washing which its lighter particles are removed and the auriferous portion concentrated within narrow limits. When this has been washed in the troon as much as is considered safe, it is removed by the hand into a circular concave wooden platter, called a *Pattri*, made of the Tali tree, and resembling a shield. In this, by a circular motion it is agitated with water, by which means an additional portion of the black sand is got rid of and washed away from the in-

elined sides of the *Pattri* by a stream of water skillfully applied. The residue is then rubbed up with a little mercury, which quickly amalgamates with the gold sand, leaving the black portion behind. The mercury containing the gold is then removed from the *Pattri*, enclosed in a fragment of cotton cloth, and placed on a bit of live charcoal, by which means the mercury is speedily vaporized, leaving the yellow gold behind entangled with the tinder of the cloth, from which, by rubbing, it is easily removed. In this state it is taken to the goldsmiths, who by fusing it with borax remove all impurities, which they say amount to 2 *ruttees* per tola weight, a fact however which we are inclined to doubt. The gold of the Gambir is considered of very fine quality, and of a rich yellow colour, differing from the Mokhudd gold, which is said to be *sufaid* (*white*). At Nukha 15 troons are constantly at work, to each of which 8 or 10 men are attached, 2 or 3 being occupied with the operations of washing, while the rest are employed digging the sand and bringing it to the troon. In the two rainy months 3 or 4 tolas weight of gold are collected by each troon, which sells here at Rs. 18 in its crude state per tola. On the Illaqua of Tillah a tax is levied by the Sirkar of Rs. 110 per annum on account of its gold.

The auriferous sandstone strata seem to stretch along the N. side of the salt range, dipping under the plain situated between this and the Hazara country, and extending west to the Indus.

*Note.*—From repeated enquiries among the gold sand washers I could not discover that *Platinum* occurs, though this is most probable, —these two precious metals being generally found associated. It would remain behind in the heavy black sand after the mercury is removed by amalgamation. The natives, contrary to their usual careful habits, take no means for recovering the mercury used in the extraction of the gold, apparently not being aware that such could be effected. In the Hazara country the grains of gold are sometimes found of such size, it is said, as to be capable of removal by picking them from the sand in which they are contained.

*April 9th.*—*Tillah.*—Sunday. Despatched diary to Lahore.

*April 10th.*—*Tillah to Lingewalla, 10 kos.*—From Tillah came on to Lingewalla, through a flat barren country, the soft sandstone strata being close to the surface and covered only by a very shallow soil. On this march water is very scarce, though to be found at a considerable



depth. Around Lingewalla there are only 3 wells dug near the bed of a small nullah, and in which the water at present is about 10 feet from surface, and very good. Gold is also collected here, and at Luggur, about 2 kos distant.

*April 11th.—Lingewalla to Moulton, 10 kos.*—Lingewalla to Moulton, through a country of the same character as previous march, but even more barren. Passed Tamun about 3 miles from Moulton, near which is a nullah called the Unkur, where gold is found. At Moulton gold is also washed from a nullah of the same name, in which are some good sections of the sandstone, conglomerates and clay strata, which dip to N. at an angle of 10°. From Tamun a road leads to Kalibagh direct.

*April 12th.—Moulton to Trapp, 4 kos.*—Came on to Trapp this morning—a very short march. This village is situated on the W. bank of the river Swauk or Surwauk which is famous for the amount of gold it yields. At present it is but a small stream, being not more than a foot deep and 30 ft. broad. On the road to Trapp passed the villages of Shah Mahomed Walla and Jubbee. At Trapp there is a good deal of cultivation, water being abundant and good near the surface.

*April 13th.*—From Trapp came unto Mokhudd by a very hilly road. This village is situated on the Indus, and in the angle formed by the junction of a nullah of the same name with that river. At this point the Indus does not appear above 400 yards wide, its course being N. N. E. and S. S. W., and confined by soft sandstone and strata and conglomerates, which rise abruptly from the river, here flowing with considerable rapidity. Conglomerates are at this point very abundant, being chiefly composed of boulders of primitive rocks cemented in a highly calcareous sand. Between Trapp and Mokhudd in many places are deposits of diluvium full of rolled boulders of rocks of all ages, apparently increasing as one approaches the Indus. Among these we obtained a beautiful species of *Delphinium*, which we have not observed before on the salt range. At Mokhudd the gold washing is carried on extensively both in the sands of the Indus and nullah of same name. According to Herr Bilas kardar, in the year 1844, 409 tolas of gold were collected, on which Rs. 1280 of tax were levied by the Sirkar.

In 1845, 272 tolas, tax Rs. 988.

In 1846, 332 tolas, Do. Rs. 990.

At present the tax is Rs. 3-2 annas per *tola* of 12 annas the rupee.

Great complaints were made by the sand-washers of their being almost bound to sell the gold they collect to the *Bioparees*, who they say will not pay them in money, but only give them an equivalent in the shape of food and clothes. The gold here sells at Rs. 15 the *tola* of 12 annas the rupee. The inhabitants of this place are described as a very lawless set, and not at all inclined to pay attention to the orders of Herr Bilas the kardar, who says he has much trouble with them.

No coal is known to occur in this neighbourhood, the rocks being all of a comparatively recent date. Sulphur occurs at Jubba, 18 kos from Mokhudd on the Indus.

Mulk Ullah Yar Khan, jageerdar of Kalibag, came with his son to meet me here, and presented a nuzzur of 11 Mahomed Shah rupees. He stated that Captain Christopher took with him on his downward trip in the Indus steamer 120 maunds of coal from Kalibag, two kinds of which there occur.

*April 14th.—Mokhudd to Kalibag by water, 12 kos.*—From Mokhudd came down the Indus in a boat in  $3\frac{1}{2}$  hours, the distance to Kalibag in this way being 12 kos, while by land it is said to be 19, and the road very bad, the villages of Kani, Miker, Shucker and Musan intervening. From Mokhudd to Kalibag the river is confined within narrow limits by the soft sandstone strata, which at the former place are nearly horizontal and of moderate height above the river, while towards the latter locality these ascend at a considerable angle, and at Dunghote, 3 miles from Kalibag, form barren rocks of great height, which overhang the river on each side and seem to stretch to the W. forming a high range of hills. The course of the stream above Kalibag seems very free of shallows or rocks, and apparently is of great depth, flowing with a considerable current. Two miles below Mokhudd, on W. bank of the river, is a small village, Ruckwan. Three miles lower down on E. side is the entrance of the Swank river, a kos below which is the small village of Peer Pyai; below this on opposite side are the villages of Goli and Tulliah, from which latter place the strata on each side of the river rapidly ascend to Dunghote, dipping to N. at an angle of  $35^{\circ}$ . Below Dunghote the salt mines appear on both sides of the river,

the salt mine village of Maree being on the E. bank, and about a mile above Kalibag, where the Indus escapes from the hills and increases in width as it flows through the level country of the Esan Khails on W. and Kucha on E. side. Kalibag is but a small place, built on the W. bank of the Indus, and close upon the river, its houses rising one above the other in terraces on the side of a salt hill. The alum kilns form the most striking feature of the village—their red mounds rising here and there in the middle of the town. This, along with various manufactories of iron goods and cloths, constitute the chief employment of the natives, who seem to suffer from goitre to a great extent, numerous individuals being seen walking about with tumours on their necks as large as their heads.

In Kalibag there are 14 alum works, 12 of which are at present working. The alum is prepared from a black, highly bituminous shale called *Rol*, containing a quantity of iron pyrites, and which is brought from Cheetah, about 2 miles distant, and several other localities in the hills around Kalibag. This shale is coarsely powdered and deposited in layers about a foot thick, between each of which a thin stratum of brushwood, grass or other combustible material is placed. These layers being piled up to a height of 20 or 30 feet are set fire to, and the whole allowed to burn slowly, water being from time to time sprinkled on the mass, to facilitate the reaction of the ingredients in the kiln on each other. When the combustion is completed, which occupies 6 or 8 months, according to the size of the kiln, the shale has assumed a brick red color and its surface is encrusted with a coating of alum mixed with sulphate of iron. This burnt kiln affords the materials for the alum preparations, and portions of it are deposited in a baked earthen vat, which is constructed close to the kiln, and a little below the level of its base, and in it are lixiviated with water. When this is saturated with the crude alum, it is run off by an opening in the lower part of the vat, into another one of the same dimensions and character, when any muddy particles are allowed to settle. After being allowed to rest in 2nd vat for 6 or 8 hours, it is then slowly run off into another smaller one in a lower level, and close to a large evaporating iron pan, into which the alum liquid is conveyed, and when boiling mixed with a brownish earth which is here called *Jumsau*, and appears identical with the saline incrustation abundant in all jungles in the N. W.

●

provinces, called *Reh*, and which is a mixture of sulphate with carbonate of soda. When a proper quantity of this has been added, which is judged of from the appearance of the liquid, the whole is allowed to settle and the clear liquid then removed into smaller earthen vats, where it is allowed slowly to crystallize for several days. By this means crystals of alum are separated of a small size and pinkish color from the brown impure mother liquor, from which they are removed, and allowed to dry for a short time. These crystals are then fused in their own water of crystallization in an iron pan, and when in a fluid state are removed into gurrachs, where for 8 or 10 days they are allowed to crystallize. The solid mass of alum in the interior of the gurrah is then pierced with a pick and the gurrah inverted so as to allow any uncrySTALLIZED alum liquor to escape. The gurrah is then broken, and the alum moulded to its form, removed to the dépôt for sale or exportation. It is generally of a light brown colour and evidently contains iron and other impurities.

By acting on successive portions of the kiln in the above way, the whole is by degrees converted into alum of marketable quality.

A kind of alum called *Kaee*, is prepared for dyers from a light grey shale containing silky crystals, of what appear to be sub-sulphate of alumina. This shale is coarsely powdered and dipped in the liquor separated from the small crystals of alum. It is then removed and dried in irregular shaped masses of about a seer weight each, which are of a brownish color. When dry these get a second dip in the same alum liquor, and are again dried, becoming of a tawny yellow colour, in which state they are sold to dyers at 8 annas per maund.

The shale from which this variety of alum is manufactured is found associated with the other alum shales around, but in moderate quantity. Its price is 5 annas per maund. In Kalibag there are about 12,000 maunds of alum manufactured annually, which here sells at Rs. 3 per maund. The average daily expenditure in all the alum works in the village is stated as Rs. 12.

*Note.*—The *Bol* or alum shale is landed by workmen at the alum works in Kalibag, at prices varying from 14 to 17 maunds the rupee, according to the distance it has to be brought, the workmen being supplied with mining instruments.

The price of the *Jumsau*, or earth which is added to the crude alum

liquid, is  $3\frac{1}{2}$  maunds for the rupee of 13 annas, which is universal here.

The lixiviating vats are 12 ft. square by 1 ft. 5 in. deep.

The evaporating vats in which the small crystals of alum are deposited are 8 ft. 8 in. long, 5 ft. 5 in. broad and 1 ft. 5 in. deep.

The gurrahs in which it is finally crystallized are 1 ft. 8 in. deep, the same breadth at shoulder, and 6 in. wide at mouth.

*April 15th.—Kalibag.*—Visited the salt mines here, which are situated on both sides of the river above Kalibag at a village called Maree. The rock salt forms a hill between Kalibag and a nullah called the Loon, which enters the Indus opposite Maree on the N. side of the river, and is worked at various points from the surface, there being no need for sinking mines, the rock salt having tumbled down in immense masses from the heights above, requiring only to be broken into portions fit for removal. The salt is of excellent quality on the E. side of the hill, but on its west side is mixed with a great deal of red marl which deteriorates its quality. The stratification of the salt is more apparent here than in any place we have seen to the E., and dips to N. W. at an angle of  $40^{\circ}$ . The marl is interlaminated with a strata of gypsum, which generally is of an earthy character, the saccharine gypsum being less abundant than in salt marls to the east. The principal salt workings on the N. side of the Indus at Kalibag are in the bed of the Loon nullah, and on its W. side, the soft sandstone strata rising up into a high range stretching N. on its E. side. About a mile from the mouth of the nullah thin strata are seen crossing its beds and extending along its W. bank, reposing on other sandstones and conglomerates, containing masses of siliceous limestone and primitive rocks. Beneath these in regular succession appears a deposit of the same white siliceous limestone with fossils, as seen to the E. and of great thickness, its lower strata being arenaceous and succeeded by an immense development of bituminous shales charged with pyrites and containing small seams of coal, none larger than we saw than  $\frac{1}{4}$  of an inch to  $\frac{1}{2}$  an inch thick. This is the shale from which the alum is made, and in it regular shafts are sunk, from which the shale is excavated; one I measured having a depth from surface of 207 feet. The working of the shale is attended with frequent accidents, from the loose nature of the strata which are constantly tumbling into the shaft. Here and there the shales are interlaminated with beds of indurated calcareous

clays which abound in fossils, these being also detected in the shales. At this point, known by the name of Chutah, one of the alum-shale shafts spontaneously took fire 5 or 6 years ago, and has since been steadily burning, and from the mouth of the mine a column of smoke is at present constantly issuing resembling that from the funnel of a large steamer. The fire is evidently the result of the chemical decomposition of the iron pyrites in the shale, an occurrence not at all unfrequent in British Collieries. No workable seam of coal occurs here as far as we could discover, its place being supplied by the extensive deposit of bituminous alum shale. Beneath the shales several strata of calcareous sandstone, conglomerates of older rocks and a succession of brown and red sandstones, which to the W. side of the salt range become mixed with an extensive series of red and blue clays, and bituminous shales, some having the appearance of a coarse coal, and containing loose masses of a species of coal resembling jet, which may be picked out of the shales in considerable quantity, but has none of the characters of a regular coal seam. About 40 or 50 maunds of this jet or fossil wood, and about the same quantity of bituminous shale, supposed to be coal, were taken as fuel by Capt. Christopher in his downward voyage in a steamer from Kalibag. The extensive development of bituminous shales in the position here noticed among the variegated sandstone strata above the salt, is quite different from what is seen in the salt range to the E. as far as we have examined, these being almost entirely confined to a position between the variegated sandstones and white siliceous flint limestone, being apparently a number of the latter deposit. Beneath the variegated sandstone shales, seemed conglomerates of immense thickness, reposing on a light colored argillaceous limestone, between which and the salt marl, are various red and brown sandstones and indurated red clays. All these strata, from the siliceous flint limestone downwards to the salt, seem to dip to the N. W. at an angle of from  $40^{\circ}$  to  $45^{\circ}$ , but in several places shew marks of having been subjected to disturbing agencies.

*Note.*—The alum shale from both sides of the salt range is carried on bullocks from the mouth of the pits to Kalibag, and if a seam or seams of such lignite as is found at the various points already noticed to the eastward would be discovered, it could be excavated in the same way as the shales and removed to Kalibag at a trifling expense.

*April 16th.—Kalibag.—Sunday.*

*April 17th.—Ditto.*—Unable to go out in consequence of heavy rain. Iron is manufactured about 30 miles to the W. in the hills at a place called Kamgoorum. Wood charcoal is used for the fusion of the ore. The iron is brought to Kalibag in coarse lumps of pig iron, and is of very inferior quality.

*April 18th.—Kalibag.*—Visited the alum shale locality of Cheestah in hopes of discovering a seam of lignite, but was unsuccessful, the coaly matter being generally disseminated through the shales. In a calcareous blue clay interlaminated with the shales, fossils are abundant, as well as in the calcareous strata above and below these.

*Petroleum* is found at a place called Jabbee, on the S. of Indus, 7 kos from Kalibag, among the hills. It exudes from the rocks and floats on the surface of water, where it is collected in quantity, and burned by the natives around in place of oil in their lamps. It is known under the name of *Gunduk ka tal*. From the description of the locality where it is found, we infer it exudes from the neighbourhood of alum shales, and is probably the result of the spontaneous combustion of these strata, during which it exudes to the surface along with watery vapour. It is of a dark brownish colour, the most penetrating smell and burns with a yellow and smoky flame. Its medicinal properties do not seem to be known to the natives, who use it only as a source of light in their lamps. At Jabbee sulphur is also found in small quantity.

*April 19th.—Kalibag to Gurree, 8 kos.*—Left Kalibag and crossed the Indus, after which came on to Gurree, the road running S. S. E. parallel with the salt range, and about 2 miles from its base, through a jungly country of little interest. In the district there is a great scarcity of water, this article being only found around the villages, the principal of which is Dankhail, 3 kos from Kalibag. At Gurree there are two wells, but only one yields water fit for drinking; the water is reached at 20 feet from surface, and hence a large supply might be procured were more wells dug.

At Tuttee, a small village 3 miles from Gurree, the *Jumsau* used in the preparation of alum, is procured. An efflorescence is scraped from the surface of the ground in the jungle around, its soluble part dissolved by water, and the solution dried up in the sun in gurras, is what

is sold to the alum manufacturers of Kalibag as Jumsau. The efflorescence is called *kullur*, that of the jungle forming *Jumsau*, while the *kullur* of the village is said to yield nitre.

*April 20th.—Gurree to Musakhail, 10 kos.*—From Gurree came on to Musakhail, through the same jungly country as in last march, where water is very scarce. The only village passed was *Swas*, about 3 kos from Gurree; from the former place the range takes a turn to the E. running again S. towards Musakhail, which is a small place in the middle of the jungle, with but little cultivation around it, and no wells, water being obtained at the foot of the range, above a kos distant, from a small stream of water which issues from the limestone rocks.

*April 21st.—Musakhail.*—Having heard that coal occurred at Numbhul, 3 kos distant across the hills, halted for the purpose of visiting the locality. The range at this point seems formed of limestone and highly calcareous sandstones. At a place called Bukh, nearly opposite to Musakhail, and about 2 kos from that place, bituminous shales occur beneath the white flinty limestone which forms the crest of the range. These shales are developed but to a small extent, and contain but a trifling amount of coal, having the appearance of a coarse charcoal, which also occurs in thin lamina in a white calcareous sandstone immediately beneath the shales, which are charged with alum and sulphate of iron. The coal is found in no regular seam, but rather in detailed fragments among the shales, and hence is quite unlikely to be of any use in a commercial point of view. From the shales downwards to the foot of the range on W. side is a development of calcareous strata, which we have observed nowhere in the range to the same extent near the shales; these may deserve the name of calcareous sandstones, but generally the rock is a fine-grained siliceous limestone containing flints, and towards its lower part abounding in fossils. From top to bottom of the range the strata all dip to the N. E. at an angle of 45°, and excellent sections are exposed in the valley, through which the stream of water flows which supplies Musakhail. This water has a milky color resembling that of the Indus, which results from its containing a quantity of calcareous mud, which a little alum very rapidly removes, rendering the water perfectly clear.

*April 22nd.—Musakhail to Dwoda, 12 kos.*—From Musakhail came on to Dwoda, by a road or path leading along the foot of the hills,



and covered with loose stones rolled from the heights above. Towards Dwoda, the range of hills increases in height, and here and there towards their base, the salt marl makes its appearance. Around Dwoda, which is but a small village, the water is salt, the supply of drinking water being obtained 2 kos distant in the hills, from a small spring which issues from the limestone strata,—all that flows from the strata inferior to these being charged with salt.

Rock salt occurs here, but is not at present excavated except surreptitiously, by the villagers around, who are generally a lawless set of Pathans.

Towards the foot of the hills in this and last march several fields of perennial cotton were seen, the plants being very green, but small.

*April 23rd.—Dwoda to Vurcha, 8 kos.*—From Dwoda came on to Vurcha—a small place situated at the foot of the hills. It is very ill supplied with water, which is found about a kos distant in a small stream which issues from the limestone strata above the salt marl, and is the only source of fresh water near—any which issues from the hills at a lower level being quite salt. The benefit of a small tank in which the fresh water might accumulate here would be immense; and as good materials for its construction are at hand, its expense would not be very great. At Vurcha there is a salt mine superintended by a Munshi of Misser Rulla Ram.

*April 24th.—Vurcha to Khond, 12 kos.*—Marched to Khond, over a most execrable road covered with loose round stones, which have rolled down from the hills above. Passed the villages of Chooah, Dokh, Jubbee and Chunkie. At the former place there is a small kutchra tank made for the use of villagers, most of whom are employed excavating salt, which is found in the red marl above the village. At Khond water is also very scarce, being as at Vurcha, only obtainable in small quantity as it issues in a small stream from the limestone rocks. Wells sunk at the foot of the hills afford only brackish water, quite unfit for use.

*April 25th.—Khond to Naree, 10 kos.*—Came on to Naree. From Khond the road leaves the hills and passes through a level cultivated country, where water however is very scarce. At Naree, a jageer of Shum Shere Sing's, there is a kutchra tank of water for the supply of the villagers. The water is brought by a conduit from Kutta, about

2 miles eastward near the hills, and where a small stream of fresh water flows. In the tank it is very muddy but sweet. Passed the villages of Vahur and Pindée, the former 3 and the latter  $3\frac{1}{2}$  kos from Khond.

*April 26th.*—*Naree to Kuhanee, 14 kos.*—From Naree marched to Kuhanee—the road level, and leading through scanty bush jungle which is cleared away around the villages, the soil appearing to produce good crops of wheat and barley. Passed the villages of Tulookur and Tessowal, the former 3 kos the latter 5 kos from Naree. Both are villages of some size, but ill supplied with water from imperfect kutchas tanks. At Kuhanee there is a kutchas tank of considerable size, being filled from the Jhelum, which is about 4 miles distant, and in which the water is sweet and tolerably clear.

*April 27th.*—*Kuhanee to Ahmedabad, 7 kos.*—Came on to Ahmedabad, a town of considerable size, situated on a branch of the Jhelum. Between Kuhanee and this place the country is well cultivated, and about 4 kos from the former is Lungur, a place little inferior in size to Ahmedabad, and about a mile from the Jhelum. Between these two places, and gradually approaching the Jhelum to the E. of Ahmedabad, are high clay banks, which about 120 years ago were those of the branch of the Jhelum which now flows to the S. of the town.

*28th April.*—*Ahmedabad to Pind Dadud Khan, 10 kos.*—Reached Pind Dadud Khan. From Ahmedabad the country is flat and covered with a saline efflorescence, which seems destructive of vegetation. Passed the villages of Surobee, Rolpore and Kourah. The former is considerably to the left of the road, and near the hills. On reaching the place received the news of an outbreak having occurred at Moultan, and of a European Regiment and one of Native Infantry having been ordered to march on that place. Drew on Misser Gyan Chund for Rs. 100, and directed him to give an advance of pay to the 6 Sowars and Munshi who accompany me, to the amount of Rs. 5 each, they professing to have no money to pay their expenses.

*April 29th.*—*Pind Dadud Khan.*—Dispatched diary to Lahore yesterday. Received a visit from Misser Gyan Chund, who informed me that 2 sahibs had been wounded at Moultan, and that the whole country was in rebellion.

A new locality for coal has lately been found at Mukrass, 3 kos from Dundhote. It is of the same character as the coal of other places

around Pind Dadud Khan, but of an inferior quality, containing much brown half decomposed vegetable matter.

*April 30th.*—*Pind Dadud Khan to Reipoor, crossing the Jhelum, 5 kos.*—Left Pind Dadud Khan this morning, and crossed the river to Reipoor, where I encamped. Reipoor is about 4 miles above Pind Dadud Khan, and at this season boats cross the Jhelum most easily at this point, the passage at Meanee being very troublesome from numerous shallows in the bed of river, and the existence of numerous deep nullahs between the chief branch of the river and Pind Dadud Khan.

*May 1st.*—*Reipore to Phiekie, 12 kos.*—From Reipoor to Phiekie, a rather long march. Water here slightly brackish, in wells 50 feet deep. Temp. in tent 100°.

*2nd May.*—*Phiekie to Kumira, 12 kos.*—Phiekie to Kumira, through a jungly country. Water abundant and pretty good. Ther. at 101°.

*3rd May.*—*Kumira to Ramnuggur, crossing the Chenab, 7 kos.*—From Kumira came on to Treka, and from thence struck off to the right to a village named Sarun, close to the bank of the Chenab, where I got into a boat, and after 4 hours on the river, reached the S. bank and came on to Ramnuggur. At this season the Chenab is greatly flooded and full of shallows, which renders its navigation highly troublesome; camels are ferried across the river about a mile above Sarun, but to get to it there are several deep nullahs to be forded. At Ramnuggur put up in the Bara-derry, which only requires to be furnished with doors to make it a very snug residence.

*4th May.*—*Ramnuggur to Oodewalla, 10 kos.*—Temperature most intense, 106°. Water bad, but abundant.

*5th May.*—*Muttoo, 8 kos.*—Oodewalla to Muttoo. Temperature in tent 108°. Water has a slight smell, but is abundant.

*6th May.*—*Suntipoora, 7 kos.*—Muttoo to Suntipoora, where water is abundant and good. Temp. 104°.

*7th May.*—Came on to Pind de dass ka kote, in the morning, and rode into Lahore in the evening.

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\* \* The *kos* mentioned in the above diary may be reckoned at 1½ miles.

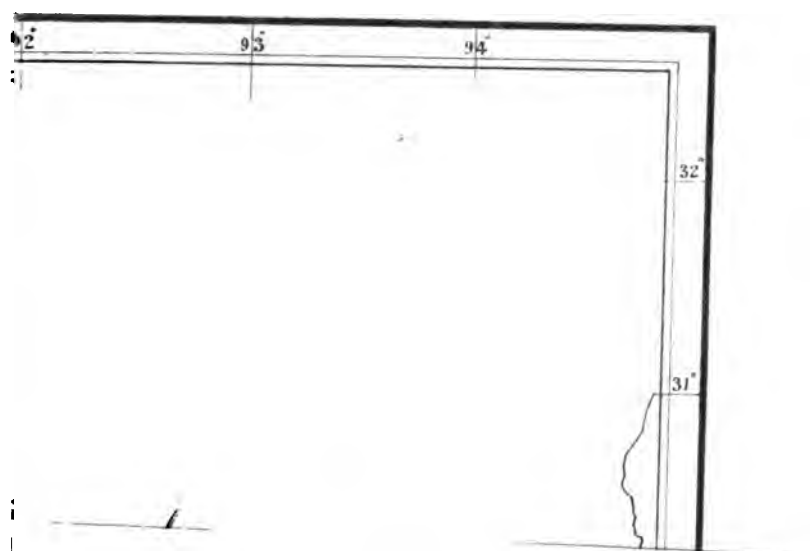
*Note on the Limits of Perpetual Snow in the Himalayas. By*  
**J. D. CUNNINGHAM, Engineers.**

I have just read Lieut. R. Strachey's interesting paper on the limits of perpetual snow in the Himalayas,\* in which he satisfactorily establishes that the elevations hitherto assigned to the phenomenon have been under-estimated, and that in truth snow is not to be permanently found at about 15,000 feet, on the southern, and about 18,000 feet on the northern boundaries respectively, instead of about 13,000 and 16,500 feet, as hitherto supposed. Lieut. Strachey very well shows that Humboldt has attached undue weight to the casual or partial observations of travellers and others in fixing upon the small numbers, but he appears to me to be himself in error when he assigns the greater elevation on the northern side almost solely to the small quantity of snow which there falls, although he is pleased to attach value to my testimony that such quantity is indeed relatively small, and thus to make me in a way a supporter of his theory.

*Humboldt's view of causes correct.*—Humboldt, in his "Cosmos" (Sabine's Trans. I. 328,) enumerates the contingencies on which the limits of the snow line are dependent, and to me he seems truly to refer the superior height on the northern side of the Himalayan chain to the general elevation of Tibet, i. e. to the heat due to radiation and reverberation even at that great height above the sea. This view is strikingly borne out by what that able officer, the late Dr. Lord, observed with reference to the Hindu Koosh.† He found the snow lying very much lower on the northern than on the southern face, and he gives as a reason for the large difference the existence of the high lands of Cabul on the south side, or the fact that these high lands contain latent heat which melts the snow, while on the northern face the slopes merge into the swampy flats of Toorkistan, scarce 500 feet above the sea, and are thus met by a cold atmosphere, down to a low level, in aid of the coldness due to a northern aspect.

\* Journ. As. Soc. of Bengal, No. 102, April, 1849.

† Reports on Sindh, Afghanistan, &c., by Sir A. Burnes, Lieut. Leech, Dr. Lord and Lieut. Wood. (Geographical Memoirs, p. 48, &c.)





*Relative heights on extreme edges of mountain belts.*—It will indeed be found that in any *broad mountain chain* resting on a plane inclined to the sea level, and running nearly east and west, the effect of latitude on temperature may be discarded, and that elevation above the particular country, and not above the general ocean, is mainly, although not solely, to be considered in determining the limits of perpetual snow on the two edges of the belt. The line of snow will rise as the plane of the country rises, and keep above it at a continually decreasing distance, until the diminishing temperature due to increasing height causes the two to coincide—a phenomenon which of course cannot occur in the temperate zones, as we know of no table-land so high as to be always frozen on the surface.

*Relative heights on opposite sides of the same single hill of a chain.*—This reasoning does not however apply to the limits of snow on the northern and southern slopes of any *one hill or mountain*, of a broad and complex chain, and as a rule, the snow will be found to lie lower on the northern than on the southern face of a single peak. In such an instance neither difference of latitude nor inclination of plane can ordinarily have any effect, and the only element to be taken into consideration is the direct play of the sun's rays, which in the northern hemisphere have most power on a hill side looking to the south. Captain Hutton, in his papers on Dr. McLelland's Journal of Natural History, had such isolated hills in view when he asserted that the southern limit of snow was higher than the northern one, and when he sought the support of my experience on the subject, as I was then, 1842, moving about in Ludákh and Kunáwur.

*Description of illustrative sketch.*—The accompanying sketch represents what I believe to be the true state of the case with regard to the Himalayas, whether a line be drawn north and south across them, between the Gogra and Ganges, or east and west in the neighbourhood of Cashmír. Towards the plains of India the limit of snow on the southern sides of the extreme hills will be found at about 15,000 feet above the sea, as Lieutenant Strachey shows, and on the northern face of the same hill, at about 12,000 feet, a figure however which I have assumed for the sake of illustration, as I know of no observations directly bearing on the subject. On the Tibetan side of the chain the heights will be found to be about 20,000 feet on the south, and 18,000,

or 18,500 feet on the north face of the same hill. These latter estimates are Lient. Strachey's, and they are, I think correct, while the southern height of 20,000 feet is an approximation only.

I have taken the height of the Manasarawar lake, viz. 15,000 feet, in making this sketch, but even Humboldt's mean elevation of Tibet, viz. 11,500 feet (*Cosmos*, I. 330,) will not affect the argument, that the distance between the planes of the mountain bases and of the snow limits goes on decreasing as the former ascend.

*Quantity of snow falling in Tibet, and the permanency or renewal of snow generally.*—With regard to the quantity of snow which falls to the northward of the main peaks of the Himalayas, I may refer to my statement at p. 238, of the 148th No. of the *Journal*, where I say that it did not appear to exceed two feet and a half in depth, where not drifted. This refers to the tract around the junction of the Sutlej and Spiti rivers. In addition to the details there given, I may also mention that the larger streams began (in 1842) to swell after the middle of February. This was due, I would say, to the radiation from the mountain masses causing the lower surface of the snow to melt—the recently accumulated snow itself forming a protection against the chilling winds, and so allowing the earth to part with its heat. At this period the temperature of ordinary springs was about 42°, while the air at sunrise was sometimes below zero, and the mercury would not rise above 60°, when exposed to the sun's rays in the early part of the afternoon. I state these particulars partly in support of what I consider to be Capt. Hutton's meaning with regard to snow not being perpetual—an opinion to which Lieut. Strachey somewhat slightly alludes.\* Both observers are right, because the one simply means that the snow is ever being simultaneously destroyed and renewed, and the other that hills of a certain elevation always exhibit a covering of snow.

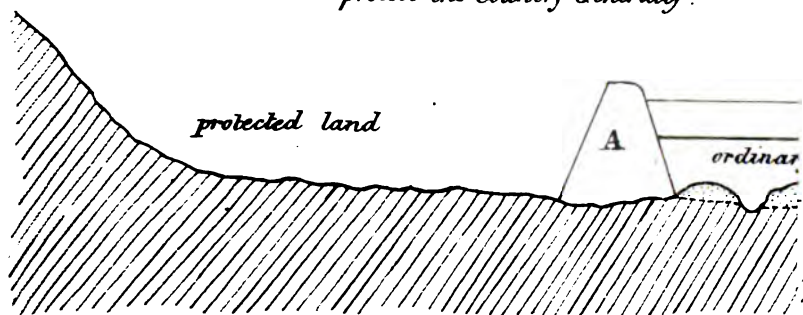
*The Tibet of the Himalayas not a plain or table-land.*—Lieut. Strachey, and indeed most people, talk of the "plains" or table-land" of Tibet, but I doubt whether between Imaus and Emodus, or any where in the valleys, or basins of the Indus and Brahmaputra to the north of the Himalayas, there are any plains. The range separating the upper courses of the Indus and Sutlej is indeed inferior in height to that which gives rise to the Ganges and Jumna, but it is still a lofty

\* *Journ. As. Soc. of Bengal*, April 1849, p. 302, note.



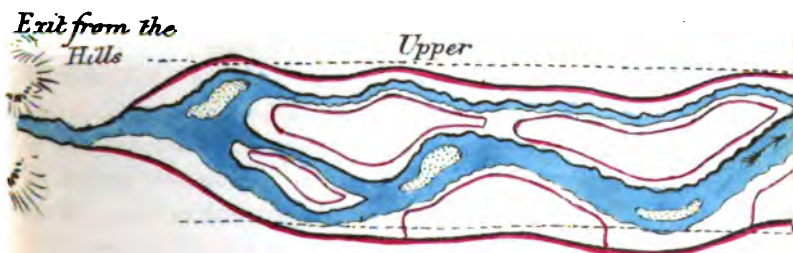
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*A—Primary or greater Embankments  
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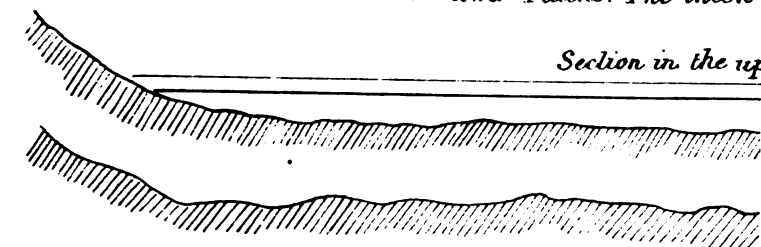
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TYPICAL SKETCH



*The dotted black line shows  
and lower Plains. The thick*

*Section in the up*



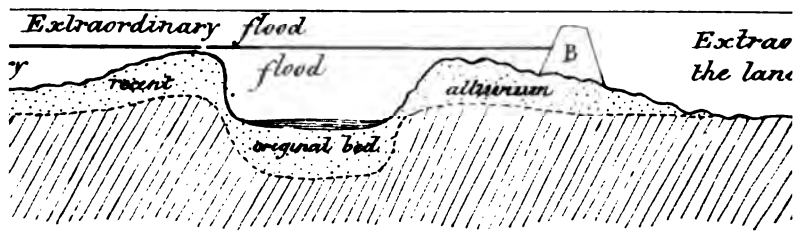
*Level of highest flood*

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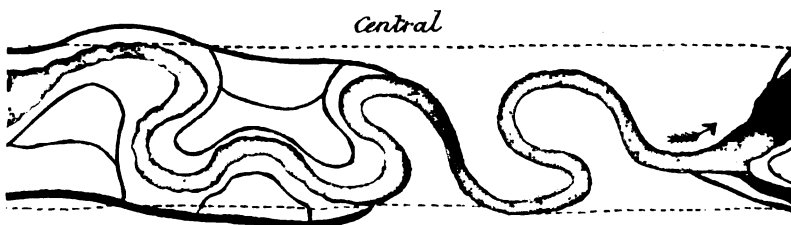


# EM OF EMBANKMENTS PROPOSED

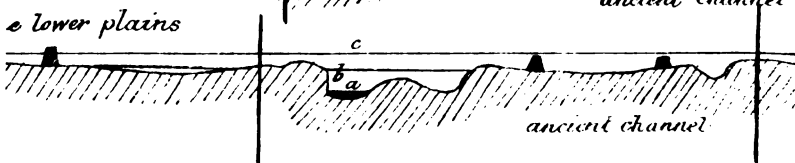
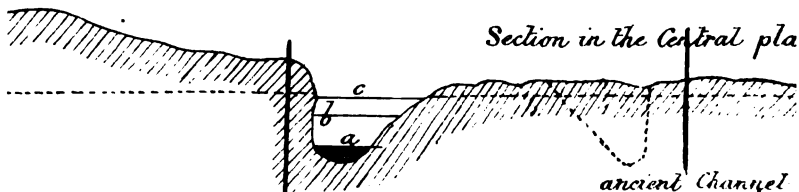
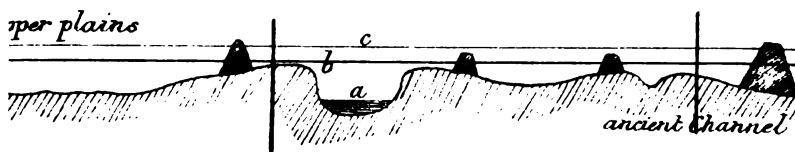
**B**—Secondary or lesser Embankments  
to protect limited tracts within  
the Belt of Variation.



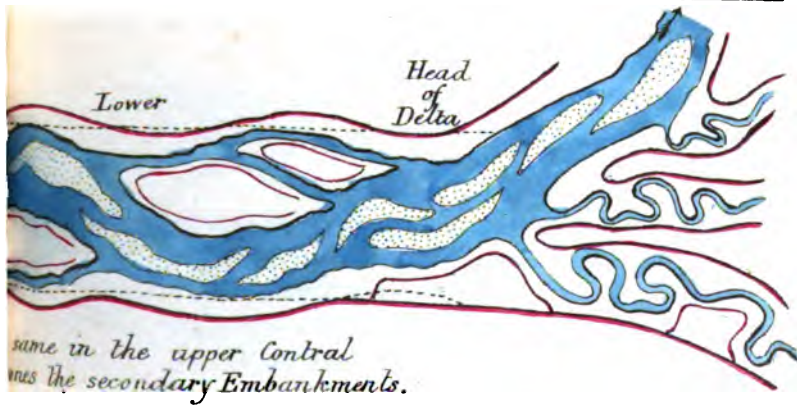
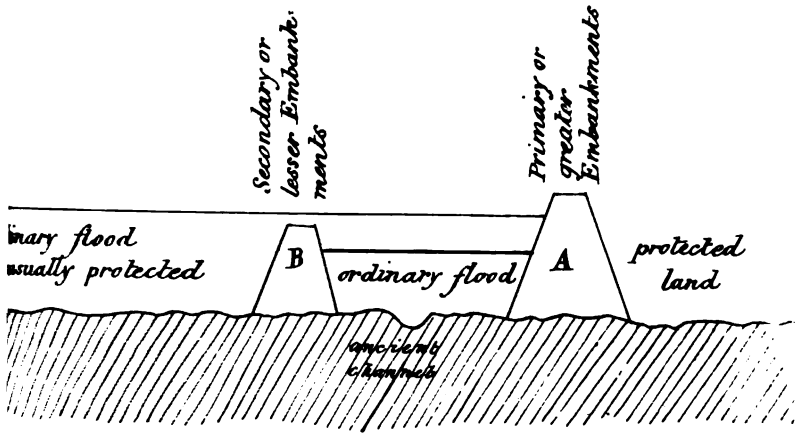
## OF A TROPICAL RIVER IN DILUVIAL PLAINS .

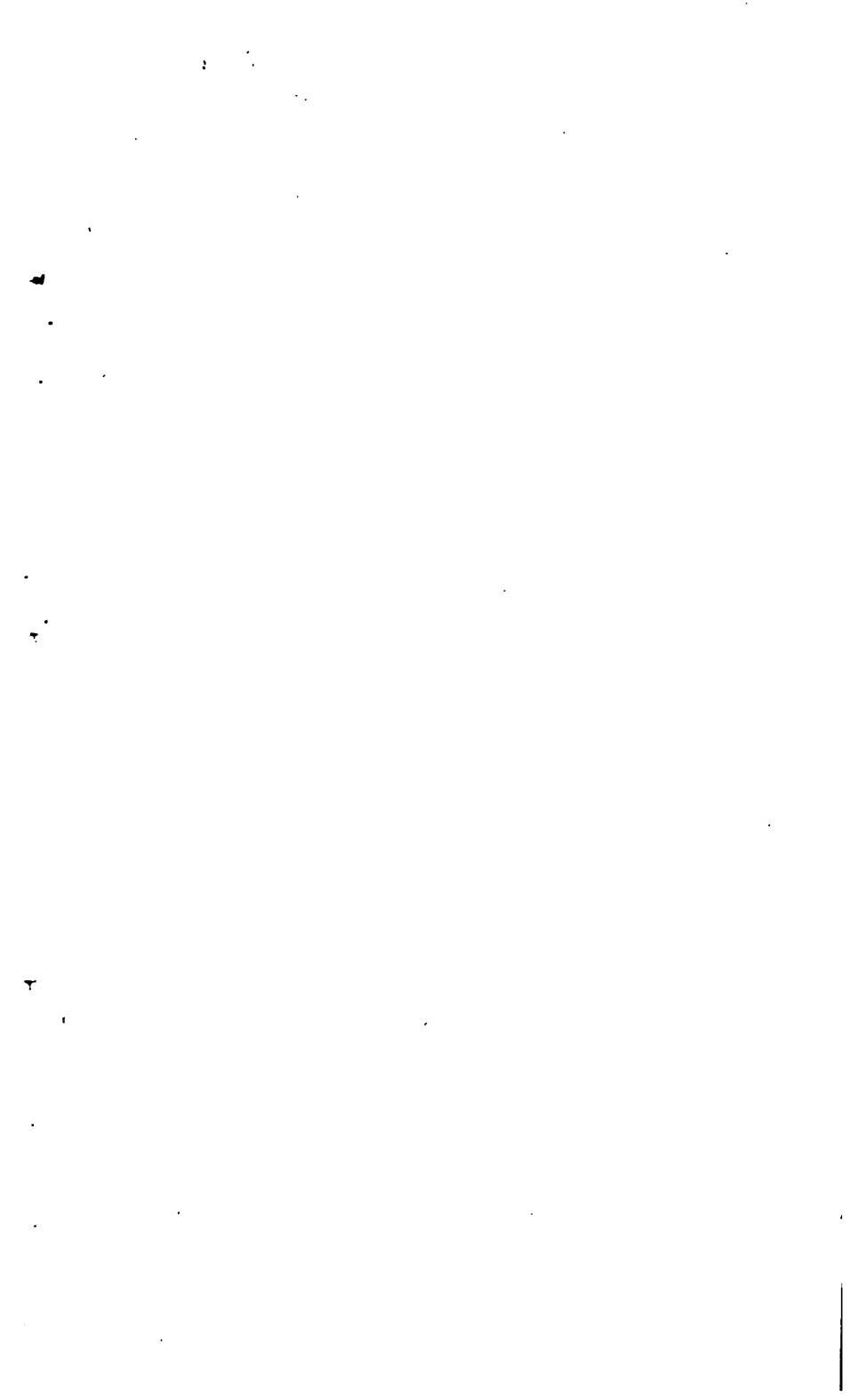


the limits of Variation of the Channel assumed as the  
red lines show primary Embankments, and the thin red



perpendicular red lines represent the breadth of the belt





range. To the northward of the Indus, or on a line running from Garo towards Yarkund, I dare say that undulating ground or moderate slopes, rather than deep ravines with steep sides, may perhaps be found.

These downs or steppes, or at least tracts, afford pasturage to the best description of shawl-wool goats, and Lieut. Strachey is right in his opinion that, elevated although they be, they are as free from snow during summer as the plains of India. What he supposes of the Kailás or Gagrí of the Manasarawar lake, viz. that the height of its (northern) snow line may be 19,500 feet, would also be fully verified on any mountains which may break the sameness of these steppes, and not be so far to the north as to be much affected by the latitude.



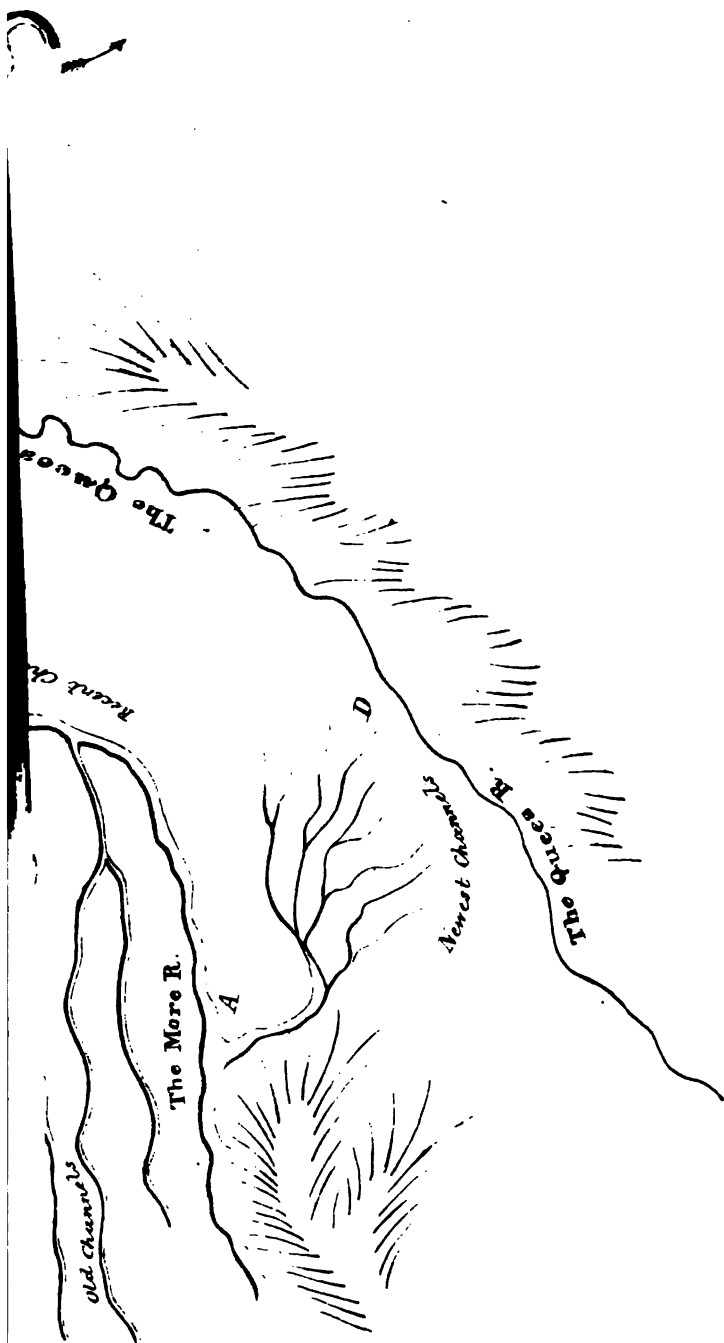
*On the Embankments of Rivers, and on the Nature of Overflowing Rivers in Diluvial Plains. By Capt. J. D. CUNNINGHAM, Engineer.*

A short time ago I addressed the Editor of the "*Englishman*" about the embankments of the Damooda and other streams, and partly because my propositions were well spoken of by that paper (see issue of the 31st May, 1849), I am induced to write to you more at length on the general question of such dikes, and also to make my views more plain by a few illustrative sketches.

*Proposed Scheme of Embankments.*—My scheme is founded on the fact that rivers, how capricious soever they may seem to be in any one neighbourhood, do nevertheless on the whole usually wind or vary within given limits, or will ordinarily be found to flow between lines parallel, at an ascertainable distance—although in their deltas and in the upper portion of their courses, they do also, after long periods, occasionally quit such belts of petty variation, and strike out new channels for themselves at considerable distances to the right or left. Hence, disregarding these latter changes as not giving cause for yearly care, I recommend that there should be two sets of embankments, one primary, and of a large section, following generally the limits of the belt of variation, and the other secondary and smaller, surrounding islands, or covering detached portions of land within the belt, which can be enclosed without materially impeding the flow of an ordinary inundation. By keeping

the larger embankments beyond the limits of constant change, all of having them attacked by the fluctuating stream will be avoided, regard will merely have to be had to sustaining the pressure of a tranquil flood or of a given height of water; while by employing no embankments likewise, much valuable land may be kept under plough, except on the occurrence of great floods, which perhaps do take place at intervals of ten, twelve or twenty years. (See Pl. X sketches I. and II.)

*The upper courses of rivers in Diluvial plains.*—In explanation of this scheme it is necessary to recapitulate the distinguishing characteristics of rivers subject to flood and running through diluvial plains. Rivers on quitting the hills rush over the surface of the plains like water spilt upon a table. The channels are shallow, and are at first formed partly by tearing up the soil below, and partly by depositing the coarser materials brought from the hills to the right and left. As banks become formed, the process of deposition is modified into leaving the coarser debris in the bed of the stream, which is accordingly raised, and the waters being impeded by the diminution of slope, seek a new channel on the original plain to the right or left of that first chosen. In large and constantly flowing streams this process is repeated until at last the general surface of the country is so much raised that the river is effectually controlled by the mass of its own deposits, and gradually sinks within them, limiting its changes to a series of reflections between two lines, parallel, as in large rivers, at five, eight or ten miles apart. In the case of small, and occasional streams, however, such as the hill torrents between the Ganges and Jumna, such adjustments of channel will never perhaps take place, and these brooks of a rainy day scarcely even now know which of the two rivers to seek, while in the case of others of greater size, as of those descending from the Burdwan and Beerbhoom hills, the settlement is in steady progress, sometimes aided or retarded by artificial "bunds" or embankments. Thus the accompanying sketch No. III. (Pl. XVII.) shows the instance of the Bānsli Nullah, which joins the Bhagiruttee near Jungypore, and sketch No. IV. shows the instance of the More, which joins the same river between Moorsheadabad and Cutwah. The old channels from A to B, toward C, had become so raised with coarse sand, assisted in the case of the More by embankments, that the *surface* of the country on either







side was but little above the *bottoms* of the respective hill streams. The mass of waters was thus sustained in the air by natural and artificial means, and perhaps on the occasion of a great flood, finding a lower level within a given distance, as in the direction of a parallel stream, than down their own channels, they at once struck out new courses for themselves towards D, as shown in the sketches. The change in the More took place during the present generation, but thirteen years ago when last seen, it had made but small progress in forming a well defined bed in the lower portions of its new course, and it had covered about twenty square miles of good soil with interlacing ribbons of barren sand. Frisi mentions similar occurrences in the smaller rivers of upper Italy, and even in the Po itself.\*

*Courses of rivers in the central plains.*—At great distances from the hills, the velocities of streams decrease, large quantities of debris cease to be borne, and the rivers continually endeavor to sink themselves to the final level of the ocean. Hence when the soil through which they flow is of a firm character, their channels become deep and regular in section, and the uncertain reflections of the upper portions are converted into well formed windings. But the tendency of these windings is to be cut through at the neck, and the variations of channel are thus kept within limits greater or smaller according to the size and force of the river, but usually somewhat narrower than in the upper plains. Generally speaking, in these central tracts rivers do not overflow the country, as in the case of the Ganges about Mirzapore, but the tortuous courses of smaller streams are sometimes invaded by the inundations of greater rivers running parallel to them. Thus in sketch No. IV. the winding course of the Qweea has now become submerged by the waters of the More, as the old channel of that river (below C) has long been by the inundations of the Bhagiruttee.

*The courses of rivers in the lower plains.*—As rivers approach the sea they for the most part flow through plains of small descent, and which are

\* *Frise on Rivers*, p. 20. It may be doubted whether the Ganges has yet become finally settled in its belt of variation with reference to the Jumna, which latter river I consider to run on a lower level than the Ganges. Thus with a little aid from art, the one might very likely be led from near Cawnpore into the other below Calpee—a change which would shorten the new canal, if it is to be used mainly for navigation, as it should be.

formed of an alluvium deposited by themselves and their affluents, which has but little coherence. The resistance offered by the soil is no longer nearly equal to the impetus of the main current, and hence all symmetry of channel is lost, and the rivers resume some of the characteristics of their upper courses, wandering over sand banks from one low shore to the other, or during floods covering the whole country with a slow moving inundation. Still the mutual action, and reaction of the stream and banks tends to establish a variation within limits, and the breadth of the belt of change can always be ascertained, and will usually be found to exceed its measure in the central plains. But disregard must be had to such alterations as that which may take the Ganges into the Nattore Jheels between Bauleah, and Dacca,\* and which would correspond in cause and character with those changes of the Bânsli and More above described. Again, after rivers begin to form deltas, the principal streams mostly continue to move onwards in their irregular courses, but the smaller outlets having necessarily a diminished current, may perhaps meet with so much resistance as to cause them to wind, as is the case with the Bhagiruttee, Jellinghee, and other effluents of the Ganges.†

Some rivers do not exhibit all of the characteristics above described. The Ganges is a good type, but the Indus and Sutlej nowhere become regularly winding, as neither does the Damooda, the proper embankment of which is an object of so much concern. The Jumna again merges in the Ganges after passing through two, and the Soane after apparently passing through one only, of the distinguishing conditions.

*The limits of the variation of rivers dependent on dynamical principles.*—The limits of the deflections or windings of rivers can be determined on dynamical principles. The elements of calculation are, a

\* Rennell's Memoir of a Map of Hindostan. Appendix, p. 345.

† Branchings off must always take place at an *angle* to the direction of the *stream*, although sometimes they may almost form a continuation of the adjoining, or producing *each* of the parent river. Hence the water enters the branch with a reduced initial velocity, or occasionally with little more than with what is due to its height as a column of fluid, and being unable to carry forward the whole of the detritus with which it is charged, the coarser portions are deposited and the head of the effluent becomes raised above the bed of the principal stream. Thus the head of the Bhagiruttee is always, as we say, "choked with sand."

wider or narrower stream with a momentum due to gravity, ever impelled in the direction of the lowest level, and passing through a resisting medium of earth, or sand or gravel. The river is first deflected to one side by an obstacle on its right, and then impelled back again by an obstacle on its left, but as it has also an onward motion of its own, the result of these mutually influencing forces is a series of oscillations on either side of a central line. This is illustrated by a top spinning at an angle, or by a carriage swaying to and fro on an uneven road, which will not always upset, although its centre of gravity may be off the perpendicular. The bounding of a ball along a plain, or the surface of a lake, is also to the point. It is urged upward by the resistance of the water, it inclines downward from gravity, and it is impelled forward by its original momentum,—the result being a waving line of progress in a vertical plane, similar to what a river exhibits on a horizontal plane. I do not think these deflections and windings of rivers have ever been investigated analytically and reduced to formulæ, but their determination is of practical value, and I hope that a competent mathematician, like Mr. Pratt, may be inclined to give his attention to the subject.

*The proper system of embanking obviously that proposed.*—These characteristics of rivers being admitted as true, it is plain that the country generally should be protected by embankments formed on the verge of the belt of variation, and that lands within the belt should be protected by inferior embankments, over which an unusual flood may sweep, and so perhaps destroy them, but without reaching the summit of the main lines. It is not proposed to enter into the details of the construction of these dikes, which must vary according to soil, exposure, &c., but it is obvious that the smaller ones should always allow a moderate space, called a “free-way,” on either side of the channel for the time being, that neither set of embankments should form sharp angles, but rather bend the current by means of a rounded trace, and that for the same reason the inner sides of the “bunds” should slope gradually into the country or towards the river, although the outer faces may be as perpendicular as the nature of the soil will allow, or as circumstances may render convenient.

*Embankments modify the tendency of rivers to raise their beds, and complicate the conditions rendering remote, but total changes of course*

*necessary.*—The natural tendency of the double set of embankments, as indeed of all dikes, will be to cause the river to carry its alluvium farther and farther, and so gradually to raise both the bed of the immediate channel, and also of the general surface within the limits of the belt of variation. The belt will thus become higher above the neighbouring plains, and will also stretch farther into them, than would have been effected by nature alone. After a time there may be danger in retaining an immense flood above the level of the country, which without such embankments would at an earlier period have sought an escape to the right or left. The question will then arise, In what directions can the river be taken so as to cause the least sacrifice of property with the greatest prospect of a long continuance in the line chosen? Such a question has now in fact to be determined with respect to the Damooda, but it can only be properly discussed after the requisite data of levels, volume of water, &c. have been ascertained. The proposition sometimes made of abandoning the “bunds” of the Damooda seems unworthy of the science of the age, and if carried out would certainly cause a great destruction of property and lead to much personal distress among the poor.

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*On the Origin, Location, Numbers, Creed, Customs, Character and Condition of the Kóech, Bodo and Dhimdí people, with a general description of the climate they dwell in. By B. H. HODGSON, Esq.*

If we commence our researches into the aboriginal tongues and races of India in its north-east corner or Assam, we find that province rich in such materials for enquiry. But the majority of the numerous aborigines of the mountains of Assam, appear to belong to the monosyllabic-tongued or Chinese stem, with which we have nothing to do. A line drawn north and south across the Brahmapútrá, in the general direction of the Dhansri river, and continued southwards so as to leave Káchár within it or to the west of it, would seem not very inaccurately to divide the monosyllabic-tongued from the Tamulian mountaineers. Possibly, indeed, some of the hill tribes to the north of the Brahmapútrá, although within the Tamulian limits, as above conjecturally defined, may yet be

found to belong to the monosyllabic-tongued races ;\* but to the south of that river, I think, it is pretty evident that such is not the case, for the Káchárians, Khasias and Gárós are, in creed, customs and languages, either identical with, or most closely affined to, the Bodo, while the Kúdi, Rábhá, and Hájong, if not rather nominal than real distinctions (Hajong, Hojai Kachari) are but branches of the great Bodo or Mécch family, whose proper habitat, be it remembered, is the plains and not the mountains. I should add, that it is a mistake to suppose the mass of the population in the *valley* of Assam to be of Arian race. I allude to the Dhékrás or common cultivators of the valley, who, as well as the Kácháris and Kóech of that valley, are Tamulians, as is proved beyond a doubt by their physical attributes, and in despite of that Bengáli disguise of speech and customs, which has misled superficial observers. The illustration of these Assamese races is, however, I believe, in better hands than mine ; and I therefore shall proceed for the present more westward. Whoso should advance from Góálpára in Assam to Aliganj in Morang would, in traversing a distance of some 150 miles along the skirts of the mountains of Bhútán† and Sikim, pass through the country of the following aborigines of Tamulian extraction : the Kóech, the Bodo, the Dhimál, the Rábhá, the Hájong, the Kúdi, the Batar or Bor, Kébrat, Pallah, Gangai, Maráha, and Dhanuk, not again to mention the Kachárians separately, they being demonstrably identical with the Bodo, and so in future to be regarded, nor further dwelling now on the Khasias and Garos than to observe that Buchanan notes them as parts of the population of Rangpúr in its old extent.‡ We may have more to say

\* In the Northern Hills also the Dhansri seems to demark the Alpine races of Tibetan origin (ending easterly with the Lhopa or Bhutanese) from the Daphlas, Akas, Bors, Abors, Mishmis, Miris and others of apparently Chinese stock or Indo-Chinese, that is, monosyllabic.

† Bhútán recte Bhútánt, the end of Bhót, Sanskrit name of the country which the people themselves call Lhó, but like the Hindus, consider it an appendage of Bhot v. Tibet, of which the former is the Sanskrit and the latter the Persian designation. The native one is Bód.

‡ 15 in 60 words of Brown's Vocabulary, are the same in Gáró and in Mécch, and the whole 60 or nearly so in Kachári and Mécch. Again, the Kacháris called themselves Bodo, and so do the Mécch ; and lastly the Kachári deities Sijú, Mai-rong and Agráng are likewise Mécch deities—the chief ones too of both people to

of the rest of these tribes hereafter. Many of them have abandoned wholly their own tongues, and a deal of their own manners. But our present business is with the Kócch, Bodo and Dhimal, and first with the first.

*Kócch Location.*—In the northern part of Bengal, towards Dálimkót, appears to have been long located the most numerous and powerful people of Tamulian extraction on this side the Ganges, and the only one which, after the complete ascendancy of the Arians had been established, was able to retain or recover political power or possession of the open plains. What may have been the condition of the Kocch in the palmy days of Hinduism cannot now be ascertained : but it is certain that after the Moslem had taken the place of the Hindu suzerainty, this people became so important that Abul Fazl could state Bengal as being “ bounded on the north by the kingdom of Kocch which, he adds, includes Kamrup.” Hájó founded this kingdom towards the close of the fifteenth century, or beginning of the sixteenth, and it was retained by his sovereign successors for nearly 200 years.\* In 1773 the Company’s gigantic power absorbed the Kocch Ráj, which once included the western half of Assam on one side and the eastern half of Mórung on the other, with all the intervening country, reaching east and west from the Dhansri river to the Konki, whilst north and south it stretched from Dálimkót to Ghóraghát. In other words the Kocch Ráj extended from 88° to 93½ east longitude, and from 25 to 27 north latitude, Kocch Bihar being its metropolis, and its limits being coequal with those of the famous yet obscure Kámrúp of the Tantras. Hájó’s representative still exercises jura regalia in that portion of the ancient possessions of the family which is called Nij Bihár, and he and the Jilpaigori and Pángá Rajas, together with the Bijni and Darang Rajas, and several of the Lords Marchers of the north frontier of Kámrúp (Barúas of the Dwárs)—all of the same lineage—still hold as Zamindar Rajas most of the lands between Sikim, Bhútán and Kámrúp, as at present constituted, and a southern line nearly coincident with the 26’ of north latitude. Sukla Dev of the Kocch dynasty divided the kingdom, and there seems to have been in later times a triple Sultanat fixed at Bihar, Rangamati and Gauhati. The

whom I restore their proper name. These are abundant proofs of common origin of Garós also.

\* Buch. Rangpur, Vol. III. p. 419, &c. &c.

Rajahs of Gauhati and their kinsmen of Darang extended the Kocch dominion eastward to and beyond the Májuli, or great Island of the Brahmapútrá. Hájó, the founder, having no sons, gave his daughter and heiress to a Bodo or Mécch chief in marriage; and to the wise policy indicated by this act (the policy of uniting the aborigines and directing their united force against intruders) was the founder of the Kocch dynasty, indebted for his success against the Moslems, the Bhútānese and the Assamese.\* Nevertheless the successors of Hájó speedily abandoned that policy, casting off the Mecch (Bodo) with scorn, and renouncing the very name of their own country and tribe, with their language, creed and customs, in favour of those of the Arians who, however resolutely they may eschew the aborigines, whilst continuing obscure and contumacious, never fail to hold out the hand of fellowship to them, when they become powerful at once and docile. In a word, Visva Simh, the conqueror's grandson, with all the people of condition, apostatised to Hinduism: the country was renamed Bihár—the people, Rájbaní; so that none but the low and mean of this race could longer tolerate the very name of Kocch, and most of these, being refused a decent status under the Hindu regime, yet infected, like their betters, with the disposition to change, very wisely adopted Islám in preference to helot Hinduism. Thus the mass of the Kocch people became Mahomedans, and the higher grades, Hindus; both style themselves Rájbaní: a remnant only still endure the name of Kocch; and of these but a portion adheres to the language, creed and customs of their forefathers—as it were, merely to perpetuate a testimony against the apostasy of the rest! The above details are interesting for the light they throw upon the *character and genius of Hinduism*, which is certainly an exclusive system, but not inflexibly so; and whilst it readily admits the powerful to the eminent status of Rajpút vel Kshatriya, it is prone to tender to the humble and obscure no station above helotism—a narrowness of polity that enabled Buddhism not only to establish itself in the

\* The Yogini Tantra denounces these three, under the appellations of Plov,\* Yava and Saumar, as the foreign scourges of the land. Buch. III. 413. The Assamese (Saumar) alluded to are the Ahoms, who held upper Assam when the Kocch held lower and middle, but with ever-varying limits.

\* Plov or Pruh is the Lepcha name of the Bhutanese, and may be the etymon of the Plava of the Tantras. The people of Bhutan call themselves Lhopá.

very metropolis of Hinduism (Bihar, Oude, Benares) but for 15 to 16 centuries\* (sixth B. C. to eleventh A. D.) to contest with it the palm of superiority. The Yogini Tantra very properly denominates the Kocch, Mléccas or aborigines, the fact being imprinted in unquestionable characters on their non-arian physiognomy, and also on the language and customs of their unconverted brethren. They are called Kavach† in the Tantra just named, Hásá by the Kácháris or Bodos of Assam, Kamál by the Dhimáls, and Kocch by the Mecch or Bodos of the Méchi, as well as by themselves, where not perplexed with Brahmanical devises. Buchanan, who was furnished with every appliance for satisfactory research, and whose sagacity was not unworthy of his opportunities, estimated the numbers of the Kocch people twenty-five years ago, at 350,000 nearly. I am not aware that any good census has since been taken, and I have failed to obtain a general estimate: but from much inquiry, aided by Major Jenkins, Dr. Campbell and Permanand Acharj, I conclude that Buchanan missed a great many of them under the disguise of Islám, that cultivation has vastly increased since his time, that the Kocch abound throughout the northern part of Rungpúr, Púrnea, Dinajpúr, Mymansing and in all Kamrup and Darang, as far as the Dhansiri river, and that their numbers cannot be less than 800,000 souls—possibly even a million or million and quarter. In Assam they are divided into Kamthali and Madai or Shara, and Kolita or Kholta, and in Rungpúr, &c. into Rájibansi and Kocch—those of the Moslem faith every where dropping their ethnographic designation. Their first priests were Déóshi,‡ their next Kolita or Kholta, and their last, the Brahmans or Múllahs. Buchanan vouches that their primitive or proper language (as still used by the unadulterated remnant of the race) has no affinity with the Prákrits, and I can attest the entire conformity of the physiognomy of all,

\* Sakya was probably born in 545 B. C. and died in 465, and that his creed was still flourishing in the eleventh century A. D. is proved by the then solemn repair of the great temple at Gaya. The persecution however was hot in the ninth.

† This is identical with Kóoch, the difference being merely that of the Sanscrit and Prakrit forms of the same word.

‡ Observe that this is the name of the extant Bodo and Dhimál priesthood, one of numerous proofs demonstrative of the affinity of all the three people.



and of the creed and customs of this remnant with those of the other aborigines around them. I have already stated that I failed to get at the unconverted Kócch, and that my Vocabulary is that of the converted. Hereafter I trust to supply this desideratum, and in the meanwhile I cannot do better than give Buchanan's unusually careful and ample account of the condition, creed and customs of this people—which, being compared with my own subsequent statement of the condition, creed and customs of the Bodo and Dhimál (of whom Buchanan says little or nothing), will satisfactorily demonstrate the affinity I have insisted on.

*Kócch Status.*—"The primitive or Páni Kócch live amid the woods, frequently changing their abode in order to cultivate lands enriched by a fallow. They cultivate entirely with the hoe, and more carefully than their (Arian) neighbours who use the plough, for they weed their crops, which the others do not. As they keep hogs and poultry they are better fed than the Hindus, and as they make a fermented liquor\* from rice, their diet is more strengthening. The clothing of the Páni Kócch is made by the women, and is in general blue, dyed by themselves with their own indigo, the borders red dyed with *Morinda*. The material is cotton of their own growth, and they are better clothed than the mass of the Bengalese. Their huts are at least as good, nor are they raised on posts like the houses of the Indo-Chinese, at least, not generally so. Their only arms are spears: but they use iron shod implements of agriculture, which the Bengalese often do not. They eat swine, goats, sheep, deer, buffaloes, rhinoceros, fowls, and ducks—not beef—nor dogs, nor cats, nor frogs, nor snakes. They use tobacco and beer, but reject opium and hemp. They eat no tame animal without offering it to God (the gods), and consider that he who is least restrained is most exalted, allowing the Gárós to be their superiors, because the Gárós may eat beef. The men are so gallant as to have made over all property to the women, who in return are most industrious, weaving, spinning, brewing, planting, sowing, in a word, doing all work not above their strength. When a woman dies the family property goes to her daughters, and when a man marries he lives with his wife's mother, obeying her and his wife. Marriages are usually arranged by mothers in nonage, but

\* The classic Zyth, ζυθος, beer without hops, as universal among the Aborigines in the absence of spirits or distilled waters.

consulting the destined bride. Grown up women may select a husband for themselves, and another, if the first die. A girl's marriage costs the mother 10 rupees—a boy's 5 rupees. This sum is expended in a feast with sacrifice, which completes the ceremony. Few remain unmarried, or live long. I saw no grey hairs. Girls, who are frail, can always marry their lover. Under such rule, polygamy, concubinage and adultery are not tolerated. The last subjects to a ruinous fine, which if not paid, the offender becomes a slave. No one can marry out of his own tribe. If he do, he is fined. Sutties are unknown, and widows always having property can pick out a new husband at discretion. The dead are kept two days, during which the family mourn, and the kindred and friends assemble and feast, dance and sing. The body is then burned by a river's side, and each person having bathed, returns to his usual occupation. A funeral costs 10 rupees, as several pigs must be sacrificed to the manes. This tribe has no letters; but a sort of priesthood called *Déóshi*, who marry and work like other people. Their office is not hereditary, and every body employs what *Déóshi* he pleases, but some one always assists at every sacrifice and gets a share. The *Kocch* sacrifice to the sun, moon and stars, to the gods of rivers, hills and woods, and every year, at harvest home, they offer fruits and a fowl to deceased parents, though they believe not in a future state. (?) The chief gods are *Rishi* and his wife *Jágó*. After the rains the whole tribe make a grand sacrifice to these gods, and occasionally also, in cases of distress. There are no images. The gods get the blood of sacrifices; their votaries, the meat. Disputes are settled among themselves by juries of Elders, the women being excluded here, however despotic at home. If a man incurs a fine, he cannot pay with purse, he must with person, becoming a bondman, on food and raiment only, unless his wife can and will redeem him.

*Climate.*—The climate of north *Bengál* or *Kocch* (including the country of the people so called, and of the *Bodo* and *Dhimáls*) is too well known to require any particular notice. It is much less healthful than that of north *Bihár*, being infested with low-fevers, which are either propagated from the wilds north and east of it, or, more probably, generated on the spot by excessive moisture and vegetation in the very extensive tracts of waste, still unhappily to be found every where east of the *Kósi* river. West of that river, or in the ancient *Mithila*, and

modern north Bihár, the climate is as much more salubrious as cultivation is more diffused. The Saul forest every where, but especially to the east of the Kósi, is malarious to an extent which no human beings can endure, save the remarkable races, which for ages have made it their dwelling place. To all others, European or native, it is deadly from April to November. Yet the Dhimal, the Bodo, the Kíchak, the Thárd, the Dénwár, not only live but thrive in it, exhibiting no symptoms whatever of that dreadful stricken aspect of countenance and form which marks the victim of malaria. The like capacity to breathe malaria as though it were common air characterises nearly all the Tamulian aborigines of India, as the Kóls, the Bhíls, the Gónds, who are all fine and healthy races of men, though dwelling where no other human beings can exist. This single fact is to my mind demonstration that the Tamulians have tenanted the wilds they now dwell in for many centuries, probably, 30,\* because a *very* great lapse of time could alone work so wonderful an effect upon the human frame, and even with the allowance of centuries, the fact stands forth as one of the miracles of human kind, which those who can explain may sneer at the *other* amazing diversities worked by time and clime on that marvellous unit, the seed of Adam! The Bodo and Dhimals, whom I communicated with, alleged that they cannot endure the climate of the plains, where the heat gives them fevers. This is a mere excuse for their known aversion to quit the forest; for their eastern brethren dwell and till like natives in the open plains of Assam, just as the Kóls of south Bihár (Dhángars) do now in every part of the plains of Bihár and Bengal, in various sites abroad, and lastly in the lofty sub-Himalayas. The Kóls are, indeed, as enterprising, as industrious, and they should be employed by every European who seeks to reduce and cultivate any part of the malarious forests of India.† But, it must not be forgotten, that the very same qualities of freedom from disabling preju-

\* There is "no cabalistic virtue" in 30, as Mr. Lyall observes in reference to his theory of the fourfold division of tertiary rocks. That number expressly is given, however, because about 3000 years back is the probable date of the emmigration of the Arian Hindus.

† How comes it that the Deyrah grantees, whom the malaria disables through their peasantry, do not procure Dhángars or Kóls, who would answer thoroughly and exactly for the purpose in view? I speak from much experience.

dices, cheerful docility, and peaceable industrious habits and temper, which render the Kóls now so valuable to us, are the inherent characteristics of most of the aborigines, requiring only the hand and eye of a paternal Government to call them forth, as in the case of the Kóls. Ages of insolent oppression drove the aborigines to the wilds, and kept them there till their shyness of all strangers had become rooted and intense. But I can answer for the Bodo and Dhimál possessing every good quality of the Kóls, in an equal or superior degree, and the Bodo have already shown us with what facility those qualities may be put in action for our benefit as well as their own.

*Physical type of all.*—The physical type of the Kocch, as contrasted with that of the Hindu, is palpable, but not so as compared with that of the Bodo and Dhimál. In other words, the physical type in *all* the Tamulians, (of this frontier at least) tends to oneness. A practised eye will distinguish at a glance between the Arian and Tamulian style of features and form—a practised pen will readily make the distinction felt—but to perceive and to make others perceive, by pen or pencil, the physical traits that separate each group or people of Arian or of Tamulian extraction from each other group, would be a task indeed! In the Arian form (Hindu) there is height, symmetry, lightness and flexibility: in the Arian face an oval contour with ample forehead and moderate jaws and mouth; a round chin, perpendicular with the forehead; a regular set of distinct and fine features; a well raised and unexpanded nose, with elliptic nares; a well sized and finely opened eye, running directly across the face; no want of eye-brow, eye-lash or beard; and lastly, a clear brunet complexion, often not darker than that of the most southern Europeans.

In the Tamulian form, on the contrary, there is less height, less symmetry, more dumpiness and flesh: in the Tamulian face, a somewhat lozenge contour caused by the large cheek bones; less perpendicularity in the features to the front, occasioned not so much by defect of forehead or chin, as by excess of jaws and mouth; a larger proportion of face to head, and less roundness in the latter; a broader, flatter face, with features less symmetrical, but perhaps more expressive, at least of individuality; a shorter, wider nose, often clubbed at the end and furnished with round nostrils; eyes less, and less fully opened and less evenly crossing the face by their line of aperture; ears larger; lips

thicker; beard deficient; colour brunet as in the last, but darker on the whole and, as in it, very various. Such is the general description of the Indian Arians and Tamulians. With regard to the particular races of the latter, it can only be safely said, that the mountaineers exhibit the Mongolian type of mankind more distinctly than the lowlanders, and that they have, in general, a paler, yellow hue than the latter, among whom there are some (individuals at least) nearly as black as negroes. Among the Kóls\* I have seen *many* Orauns and Múndas nearly black; whereas the Larkas or Hós (says Tickell) are as pale, and handsome too, as the highest caste Hindu? The Kóçch, Bodo and Dhimál are as fair as their Bengali neighbours on one side, and scarcely darker (especially the Bodo) than the mountaineers above them on the other side, and whom (the latter) they resemble in the style of their features and form, only with all the physiognomical characteristics softened down, and the frame less muscular and massive. The Kóls have a similar cast of face, and a very pleasant one it is to look upon in youth, exhibiting ordinarily far more of individuality, character and good humour than the more regular but tame and lifeless faces of the Arian Hindus.

*Bodo and Dhimál Location.*—I proceed now from the Kocch tribe to the Bodo and Dhimál tribes, who occupy the entire northern and eastern skirts of the Kocch country, between the open plains and the mountains, both of which sites, generally speaking, they avoid, and adhere to the great forest belt that divides the two, and which is, on an average, from 15 to 20 miles broad. The Dhimáls, who seem fast passing away as a separate race, and whose numbers do not now exceed 15,000 souls, are at present confined to that portion of the Saul forest, lying between the Konki and the Dhorla or Torsha, mixed with the Bodo, but in separate villages, and without intermarriage. But the Bodo are still a very numerous race, and extend, as foresters, from the Súrmá to the Dhansri, and thence, *viâ* Bijni and the Bhútan and Sikim Tarai, to the Konki, besides occupying outside the forest limits, a large proportion of central and lower Assam. In the divisions of Darang and Chatgari they constitute the mass

\* Kól is an old and classical name, and the best I think for the great mass of aborigines intervening between the Bhils, the Gonds, and the Ganges—at least till we know them better. The Orauns, Mundas, Kóls proper and Larkas, seem to be distinct, and the chief families or stirpes.

of the fixed population; they abound in Chárdwár and Noudwár: in Nougáon and Tularam's country, they are the most numerous tribe next to the Mikirs and Lalongs; in Kámrúp next to the Dhékrá and Kocch; whilst in the marches or forest frontier of the *north*, from Bijni to Ali-ganj of Morung, they form the sole population, except the few Dhimáls, who are mixed with them; and in the *eastern* marches from Gauhati to Sylhet, they are less numerous only than the Gárós, Rábhás and Hájóngx, not to mention, that the two last, if not all three, are but Bodos in disguise. I look upon the Rábhás as merely the earliest and most complete converts to Hinduism, who have almost entirely abandoned the Bodo tongue and customs, and upon the Hájóngx or Hojáí Kácháris of Nowgong, as the next grade in time and degree of conversion, who now very generally affect a horror at being supposed confreres in speech or usages with the Bodo, though really such. Nor have I any doubt, that the Gárós are at least a most closely affiliated race, and no way connected with the monosyllabic-tongued tribes around them.\* I do not, however, at present include the Gárós, or Rábhás or Hájóngx among the Bodo, who are now viewed as embracing only the Méches of the west and the Kácháris of the east and south; and, so limited, this race numbers not less than 150 to 200,000 souls. An accurate general census seems out of question except for Assam, but the above enumeration is given as an approximate result of several statements obligingly supplied to me by Mr. Kellner, Mr. Scott, Dr. Campbell, and that enlightened traveller Permanand Acharya. Thus the Bodo race extends from Tipperah and the country of the Kúkis on the south-east, to Morung and the country of the Kichaks to the north-west, circling round the valley of Assam by the *course of the Dhansri*, en route to the north, though Major Jenkins assures me that Bodos may be found even east of that river in the Assam valley. The latitude and longitude of the Bodo country are the same with those of the Kocch country, to speak without any affectation of a precision the subject does not admit of, and thus we may say the Bodo extend from 25 to 27 north latitude, and from 88 to 93½ east longitude; and that the Dhimáls are confined to the most westerly part of this wide range of country, or that portion lying between the Konki and the Dhorla. My

\* See Note at page 703.

personal communications with these tribes were chiefly with those still found in all their primitive unsophistication on the banks of the Méchi, and from much intercourse with these, during four months, I conclude that neither people have any authentic ancient traditions. Nevertheless the ancient connexion of the Dhimáls with the west, and of the Bodo with the east part of north Bengal, is vouched by the facts, that a tract of country lying between the Konki and the Mahananda is still called Dhimáli; and a still larger tract situated between the great bend of the Brahmaputra and the Gáró hills is yet called Méchpára. The close connection of the Bodo with Kámrúp, is further confirmed by the facts of the mass of the people being still found there, though under the name of Káchári, and by the intimate affinity of the Bodo speech and customs with those of the Gáró. The so-called Káchár Rajah is a new man and alien to the Bodo race, and so is the mass of the people of Káchár. But Túlárám is a Bodo; and the late Rajah of Karaibári another; and the Kalang-dwár chief a third; and among the Lords marchers of the southern confines of Assam, others might once, if not still, be found; for when the keeping of the northern marches (towards Bhutan) was entrusted to the Kóech race, that of the southern dwárs or doors (towards Gáró and Nágá land) was committed to the Bodo tribe, that is, to its chiefs. It would not appear that any chief of Dhimál race now exists: but the scattered remnant of this race assure me that they once had chiefs when they dwelt as a united people in Morung, on the banks of the Kaval (Kamla) whence they removed to the Téngwá, and ultimately to and across the Konki, 60 years ago, in order to escape from Górkhalí oppression. Of the few lately extant chiefs of Bodo race, the Karaibári Rajah's estate is transferred to the stranger, and the Kalang and Túlárám chiefships are shorn of much of their "fair proportions." But in the days of Hájó, the Kóech founder, as well as in those of some of his more prudent successors, the Bodo seem to have had great political consequence, and if Hajos' descendants had steadily adhered to the wise maxims of their ancestor, their power might longer and more effectually have defied its enemies, whereas most of the Kóech Rajahs followed the illiberal Arian maxims of Viswa Sinh, and thus the Bodo were driven back upon their beloved forests, retreats which, speaking generally, neither they, nor the Dhimáls, have since quitted, save in Assam. I proceed now to the consideration of the

status, creed and customs of the Bodo and Dhimal. Upon these points the two people have so much in common that though I have myself gone through each particular separately in regard to each people, I shall spare the patience of my readers by aggregating what is common, and separating only what is particular, to the Bodo and Dhimal.

*Status—Condition.*—The condition or status of the Bodo and Dhimal people is that of erratic cultivators of the wilds. For ages transcending memory or tradition, they have passed beyond the savage or hunter state, and the nomadic or herdsman's estate, and have advanced to the third or agricultural grade of social progress, but so as to indicate a not entirely broken connexion with the precedent condition of things; for, though cultivators, all and exclusively, they are nomadic cultivators, so little connected with any one spot that neither the Bodo nor Dhimal language possesses a name for village.\* Though dwelling in those wilds, wherein the people of the plains (Ahirs and Gwallas) periodically graze immense numbers of buffaloes and cows, they have no large herds or flocks of their own, to induce them to wander; but, as agriculturists little versed in artificial renovative processes, they find in the exhaustion of the worked soil necessity, or in the high productiveness of the new, a temptation, to perpetual movement. They never cultivate the same field beyond the second year, or remain in the same village beyond the fourth to sixth year. After the lapse of 4 or 5 years they frequently return to their old fields and resume their cultivation, if in the interim the jungle has grown well, and they have not been anticipated by others, for there is no pretence of appropriation other than possessory, and if, therefore, another party have preceded them, or if the slow growth of the jungle give no sufficient promise of a good stratum of ashes for the land when cleared by fire, they move on to another site, new or old. If old, they resume the identical fields they tilled before, but never the old houses or site of the old village, that being deemed unlucky. In general, however, they prefer new land to old, and having still abundance of unbroken forest around them, they are in constant movement, more especially as, should they find a new

\* *Arva in annos mutant et superest ager!* So immutable is human nature that the descriptions applied to our ancestors in their pristine state are absolutely and most significantly true of similarly circumstanced races now abiding in the forest jungles of India.



spot prove unfertile, they decamp after the first harvest is got in.\* They are all in the condition of subjects (of Népál, Sikim, Bhútán or Britain) having no property whatever in the soil they till, and discharging their dues to the Government they live under (Sikim, for example) 1st, by the annual payment of one rupee per agricultural implement, for as much land as they can cultivate therewith, (there is no land measure;) 2nd, by a corvée or tribute of labour for the sovereign and for his local representative. They calculate that they can raise 30 to 40 rupees worth of agricultural produce with one agricultural implement, so that the land tax is very light; and the corvée is more irksome than oppressive. It requires them, on the Rajah's behalf, to quit their homes for 3 or 4 days, thrice a year, in order to carry burdens for him into the hills, whenever he has goods coming from the plains; but, on the representative's behalf, to work only on the spot. Four times a year they must help to till his fields; also to build or repair his dwelling-house; to supply him with fuel and plates (leaves) whenever he gives a feast; and, lastly, they must pay him one seer of cotton each year, for every cotton field they have. Very similar is the condition, in regard to taxation, of the Bodo and Dhimáls, under the Népál and Bhútán Governments. Under the British, the permanent cultivators of the open lands of Kámrúp are subject to the usual burdens, incidental to our rule, which they discharge with ease, owing to their industrious and orderly habits. Major Jenkins gives them the highest character, observing that—"they are a remarkably fine peasantry and have very superior cultivation of the permanent kind." This is abundant proof of the docility of the Bodo, and strong presumptive evidence that their erratic habits and adhesion to the wilds, elsewhere, are the result of oppression, at least as much as of the bias of pristine custom. But, as the Kámrúpián Bodo have abandoned with their erratic propensities, a deal of whatever is most characteristics of them as a distinct race, I resume the delineation of them and of the Dhimáls, as still found in primitive simplicity between Bijni and Mórang. There

\* Such are the primitive habits, still in use from the Konki to the Monásh, and which are most worthy of study and record, as being primitive, and as being common to two people, the Bodo and Dhimál, though abandoned by the Kámrúpián and most numerous branch of the Bodo.

they are migratory cultivators of a soil, in which they claim no sort of right, proprietary or possessory, but which they are allowed to till upon the easy terms of a quit-rent and labour tax, because none others will or can enter their malaria-guarded limits. There is no separate calling of herdsman or shepherd, or tradesman or shop-keeper, or manufacturer or handicraft, alien or native, in these primitive societies, which admit no strangers among them, though they live on perfectly amicable terms with their neighbours, and thus can always procure, by purchase or barter, the very few things which they require and do not produce themselves. To a person accustomed to the constitution of social bodies in India, whether Arian or Tamulian, it must seem nearly impossible, that communities could exist without smiths, and carpenters, and potters, and curriers, and weavers, not to mention barbers. Yet of these helot craftsmen, whose existence forms so striking a feature of all Indian societies, and whose origin and status so much need\* illustration, there is no trace among the Bodo or Dhimáls, though they live apart from all others, like the Khóns, Góns and Kóls, who *have* these aliens among them; and necessarily so, for their inaccessible position and predacious propensities, would otherwise too often cut them off from all aid of craftsmen, whereas the Bodo and Dhimál, who dwell upon the plains, and on peaceful equitable terms with their neighbours, can always command such services, or rather their products in the markets. The Bodo and Dhimáls have no buffaloes, few cows, no sheep, a good many goats, abundance of swine and poultry, some pigeons and

\* When we consider the indispensableness of the services of these craftsmen, it is remarkable that they should have continued to the present day, in a helot or out-caste state, not only among the Arians, but even among the Tamulians, not only in the plains but in the mountains. My belief is, that most of the Tamulians on the Arian conquest, retired to the mountains and jungles, and that those who remained were reduced to helotism and became the artizans of Arian society, such as we now see them. Ages afterwards some of them passed into the fastnesses and wilds occupied by their Tamulian brethren, in freedom, and fierce defiance, for the most part, of their Arian enemies. These immigrants are the recent helot craftsmen of the Góns, Khóns and Kóls, such as we now see them; Tamulians in origin like the masters they serve, but from whom they fail to obtain better treatment than from the Arians. No common tie is recognised; and ages of freedom and of servitude have left no common trait of character.

ducks. They have no need, therefore, of separate herdsmen, unless it were swine herds, and these might be very useful in feeding their large store of pigs in the forest. But they have no such vocation among them, each family tending its own stock of animals, which is entirely consumed by that family, and no part thereof sold, though the proximate hill-men would gladly purchase pigs from them. But they love not trade nor barter further than is needful, and their need is confined to obtaining (besides rice) a few earthen and metallic culinary utensils, still fewer agricultural implements of iron, and some simple ornaments for their women—all which are readily obtained at the Kocch marts in exchange for the surplus cotton and oil seed of their efficient agriculture. Each man builds and furnishes his own house, makes the wooden implements he requires, and is his own barber, or his neighbour for him, and he for his neighbour. He uses no leather and he makes basketry for himself and family, whilst his wife spins, weaves and dyes the clothes of the family, and brews the beer which all members of it freely consume. Thus, all manufactures are domestic, and all arts. The Bodo and Dhimáls are generally averse from taking service with, or doing work for strangers, whether as soldiers, menials, or carriers, though there are a few soldiers and servants at Dorjiling belonging to the Bodo race, who conduct themselves well in their respective capacities. Among their own communities there are neither servants nor slaves, nor aliens of any kind; and whilst their circumstances tend to perpetuate equality of means, neither their traditions, their religion nor their usages sanction any artificial distinctions of rank. Though they have no idea of a common tie of blood, yet there are no diverse septs, clans or tribes, among them, nor yet any castes; so that all Bodo and all Dhimáls are equal—absolutely so in right or law—wonderfully so in fact. Nor is this equality the dead level of abject want. On the contrary, the Bodo and Dhimáls are exceedingly well-fed, and very comfortably clothed and housed, and so soon as you know them—for they are very shy of strangers—their voices, looks, and conduct all proclaim the absence of that grovelling fear, and cunning which so shock one in one's intercourse with the people of Bengal, and the mass of whom are much worse fed, and distinctly worse clothed and housed, than either Bodo or Dhimáls.

*Notes.*—It having been already stated, that these people are, and have been, for ages, in condition of subjects of foreign Govern-

ments, I need hardly observe that they have no *public laws* or polity whatever, nor even any traces of that village economy which so pre-eminently distinguishes Indian-Arian societies. Their habits are too simple and migratory to allow of the existence of the village system, with its train of hereditary functionaries and craftsmen. They dwell in the forest in little communities, consisting of from 10 to 40 houses, which they are perpetually shifting from place to place. Each of these communities is, however, under a head called *Grà* by themselves, *Mondol* by their neighbours. To the foreign Government they live under their *Grà* is responsible for the revenue assessed which he pays periodically to the Rajah's representative—the *Choudri*—in cowries or rupees, the only currency. He has no scribe, nor keeps any accounts, his simple explanations to the *Choudri* being verbal. To the *Choudri* he is answerable, likewise, for the keeping of the peace and for the arrest of criminals : but crimes of a deeper dye are almost unknown, and breaches of the peace, very rare. Should a murder or robbery occur the *Choudri* would take cognizance of it, assisted by 3 or 4 proximate heads and elders of villages, and report to the Rajah, from whom alone in such cases, a decision could issue. With regard to his own community, the head of the village has a general authority of voluntary rather than coercive origin ; and which, in cases of the least perplexity is shared with the heads or elders of two or three neighbouring villages. Those who offend against the customs of the Bodo or *Dhimál*, that is, their own customs, are admonished, fined, or excommunicated, according to the degree of the offence, the village priest being called in, perchance, to give a higher sanction to the award. The same Jury-like tribunal, seems to have almost exclusive cognizance of *civil law*, or the usages of each people in regard to inheritance, adoption, divorce, &c. Marriage is rather a contract than a rite, and, as such, is dissoluble at the will of either party ; and if the divorce be occasioned by the wife's infidelity, the price paid for her to her parents, must be refunded by them. Dower is not in use, and women, in general, are deemed incapable of holding or transmitting property. All the sons get equal shares, nor is there any nice distinction of sons by marriage, adoption or concubinage. Adoption is common and creditable, even if there be one son of wedlock : concubinage is rare and discreditable. Daughters have no inheritance nor dower : but if their parents be rich

and give them marriage presents, such are held to be their own, and will be retained by them in the event of divorce. Neither Bodo nor Dhimal can marry beyond the limits of his own people, and if he do, he is severely fined. Within those limits only, two or three of the closest natural ties are deemed a bar to marriage. In the event of divorce, the children belong to the father or the sons to the father, and the daughters to the mother. If the husband take the adulterer in the fact, he may beat him and likewise the wife; but no more;\* and thereafter, if he please, he may put his wife away, when she and the adulterer will continue to abide together as man and wife, without scandal, but without marriage rite; or, if the husband please, he may pardon her and frequently does so, should the offence have been the first, and committed with one of the tribe and not with an alien. Chastity is prized in man and woman, married and unmarried; and, as a necessary consequence, women are esteemed and respected, and divorce and separation rare, notwithstanding the bad footing upon which the custom or law of these nations sets the nuptial union. Syphilis is absolutely unknown among the Bodo and Dhimal,—a fact that speaks volumes, and one that renders it scarcely necessary to add, that any class of women, devoted to unchastity, is a thing for which their languages have no name, and their manners, no place. Filial piety is not a marked feature in their character, nor perhaps the want of it. Sons, on marriage, quit the parental roof, and sometimes, previously: but it is deemed shameful to leave old parents entirely alone, and the last of the sons, who by his departure, does so, is liable to fine as well as disinheri- tance. Infanticide is utterly unknown, with every savage rite allied to it, such as human sacrifice, self-immolation and others, too frequent among rude people. Daughters, on the contrary, are cherished, and deemed a source of wealth, not poverty, for every man must buy his wife with coin or labour, and 'tis very seldom that the price comes to be redemanded by the wronged and unforgiving husband. There is no bar to re-marriage, and satti is a rite held in abhorrence.

*Learning.*—*Of learning and letters*, the Bodo and Dhimals are totally devoid, and always have been so. The numerals of the cardinal scale

\* Among the Parbettias of Nepal the wronged husband may, nay must, slay the adulterer.

are only seven in the Bodo tongue, ten in the Dhimáls, and they have no ordinals at all. Beyond 7 or 10 they count by the Hindu ways of fours and of scores, and in this manner they can reckon to 200. Very few of the Bodo or Dhimáls have learnt to write the neighbouring Prákrits, but many can converse in them, particularly in the corrupt Bengálí prevailing from the Kosi to the Brahmapútra. To the segregated manner of life of the Bodo and Dhimáls, and to the practice of both people of marrying only within the pale of their own folk, I ascribe the present purity of their languages.

*Religion.*—The religion of the Bodo and Dhimáls, is distinguished, like their manners and customs, by the absence of every thing that is shocking, ridiculous, or incommodious. It lends no sanction to barbarous rites, nor does it hamper the commerce of life with tedious insane ceremonial observances. It takes less cognizance than it might advantageously do of those great sacraments of humanity, baptism, marriage, and sepulture, withholding all sanction from the first, and lending to the other two, especially marriage, a less *decided* sanction than the interest of society demand. The deplorable impediments to the business of society, occasioned by the Hindu (Arian) religion, are too well known to call for specification. But even some of the Tamulians are pestered with usages under the guise of religion, which are alike injurious to health and convenience,\* or are pregnant with cruelty.† From all such crimes and mischiefs the religion of the Bodo and Dhimáls is wholly free. With the most striking events or dearest ties of life it meddles little directly, confining itself almost exclusively to the propitiation of the superior powers by offerings and sacrifices. A Bodo or Dhimál is born, is named, is weaned, is invested with the toga virilis, without any intervention of his priest, who is summoned to marriages and funerals chiefly, if not solely, to perform the preliminary sacrifice, which is indispensable to consecrate a feast, for no Bodo or Dhimál will touch flesh, the blood of which has not been offered to the gods; and, flesh constitutes a goodly proportion of the material of those feasts which solemnise funerals and weddings alike.

† Khasias. Robinson's Assam, p. 413 and Buchanan's Reports, vol. III. p.

‡ Gárós. Elliott. Asiatic Researches, III. 29. Khonds. Macpherson's Reports and Taylor's Account, vide Madras Journal, No. 16, and Calcutta Review, No. IX.

*Priesthood.*—The office of the priesthood is not an indefeasible right vested in a caste, nor is the profession at all exclusive. The priests are native Bodo or Dhimál, no way distinguished from the rest of the community, either before or after induction. Occasionally the son will succeed the father in this office, but rarely; and whoever chooses to qualify himself, may become a priest, and may give up the profession whenever he sees fit. More than this, the Elders of the people may and do participate in the functions of the priesthood, and even exercise them alone, so that it is not improbable there was a time when the civil heads of the community were likewise its ecclesiastical directors. This imperfect constitution of the clerical office has, probably, proved upon the whole a great blessing to these people by saving them from the trammels of *all* refined Paganism, (Egyptian, Classic, Indian,) though it has had the necessary ill effect of keeping their religious ideas in a state of extreme vagueness. I am not inclined to consider "the natural man" as a savage; and I have no hesitation in calling the religion of the amiable Bodo and Dhimáls, the religion of Nature, or rather, the natural religion of man. It consists, clearly enough, of the worship of the most striking and influential of sensible objects—of the "starry host," and of the terrene elements—with a vague but impressive reference of the *powers* displayed by these sensible objects to an immaterial or moral source, unknown indeed, but still adored as Divine, and even as a divine Unity.\* It is true that these latter conceptions are too vague to be denominated, strictly speaking, ideas, proper to these people, much less positive tenets of their creed; and hence their languages have no word for God, for soul, for heaven, for hell, for sin, for piety, for prayer, for repentance. It is true that their gods are many, and are all void of definite moral attributes (save when their own meaner passions of vanity and anger and grief are occasionally ascribed to them). But still, in the pre-eminence assigned, however vaguely, to one (or two) of these gods, we cannot deny to these simple-minded races the germ of a *feeling* of God's unity; and when they appeal to Him as the avenger of perjury, the sanctioner of an oath—we must acknowledge that the moral senti-

\* I refer the caviller to Pope's universal prayer, and to that famous fane of antiquity dedicated to the unknown God.

ments of their own nature irresistibly impel them to ascribe like sentiments to the godhead. Now, in every serious matter of dispute that cannot be decided by testimony, usually so called, oaths and ordeals are had recourse to—and both, as substitutes for, and confirmatives of, evidence, according to the ancient Jewish (nay, universal) notions on this head. But oaths and ordeals are appeals to the moral nature of the Divinity: nor can it be denied that, though the practical religion of the Bodo and Dhimáls consists of idle offerings and sacrifices to trivial deities, yet that supplications for protection from danger, and thanksgivings, when it is over, accompany these offerings and these sacrifices, forming a part, how inconsiderable soever, of the religious rights of the people as conducted by the priesthood. The priests, or the elders, superintend the administration of oaths and of ordeals: the priests *alone* direct and conduct those high festivals, which thrice a year are celebrated in honour of the Elemental gods, and once a year in honour of the household divinities; as likewise those occasional acts of worship, which originate with more or less diffused, or individual, calamity. The calamities to which the Bodo and Dhimál stand most exposed, are small-pox and cholera, which sorely afflict them; and drought, blight, and the ravages of wild elephants and rhinoceroses, from which their crops suffer not less. Diseases are considered to arise entirely from preternatural agency, and hence there are no medical men, but a regular class of exorcists, who are a branch of the priesthood, and whose mode of relieving the possessed or sick will be described presently. They are called Ojhá, and are the sole physicians. Small-pox is the direst scourge of the Bodo and Dhimáls; next cholera (since 1818); next itch; then diseases of the intestines, as diarrhoea and dysentery; then fever; then goitre; diseases of the liver and lungs are very rare; and syphilis is unknown. The Bodo and Dhimál, though healthy races, are not long-lived nor prolific. Grey hairs are less common than in the hills or plains: 60 is deemed a great age: a family of 8 or 9 living children is hardly known: 5 or 6 alive is nearly the maximum; and 2 to 4 the mean. The hazards and the importance of agriculture to the Bodo and Dhimál, are sufficiently indicated by their creed, the three chief festivals of which have almost exclusive reference thereto. Great as are the ravages committed on the crops by insects and wild animals, drought seems to be dreaded still more than either, so that among all



the numerous gods Jupiter Pluvius, as typed by the rivers, commands a reverence, second to none with the Dhimáls, second to one or two only with the Bodo. *All* the rivers between the Cusi and the Torsha are chief divinities of the Dhimáls—all those between the Konki and the Bar nadi, prime deities of the Bodo. Fire, however, indispensable agriculturally for the clearing of the forest, is by no means equally revered; nor the earth, which yields all; nor the noble forest, so cherished and so many ways indispensable; nor the mountains whence come these very rivers; nor even the sun and moon, which alone of the starry hosts are worshipped at all. All these deities are worshipped devoutly indeed, but none with such earnestness as the rivers: and yet the rivers flow too low to allow of their waters being turned to irrigation, so that it is as an index of copious rains, upon which exclusively Bodo and Dhimál crops are dependant, that the rivers are entitled to this reverence, though crossing as they do so frequently and so directly the route of communication through the country of these tribes, 'tis no wonder that they have unusually commanded attention. When I first obtained lists of the Bodo and Dhimál divinities, at once so numerous and so devoid of attributes, I was exceedingly perplexed what to make of these gods, how to render them at all intelligible to myself or others. But one key to the enigma was soon found in the Hindu pantheon—another in the best frontier maps, especially those of Rennell, where the rivers proved to be so many Dii majores. A third class of gods, and a very important and characteristic one, in regard to the Bodo more particularly, remained, however, for solution. These following the people themselves, I have denominated the 'household gods,' because their worship is conducted *inter parietes*. 'National,' however, were the fitter term, for these are the original deities of the whole people, and though their worship be conducted at home, or in each house, the whole neighbourhood participates through the medium of the accompanying sacrifice and feast, and reciprocally at every householder's of the village, once a year in solemn pomp, and more frequently and quietly as occasion may require. Not to mention that these deities likewise share with the elemental gods the high triennial festivals above adverted to; for how ample soever the Bodo or Dhimál pantheon, their practical religion is as simple as their manners, and they dispose of their superfluous divinities by adoring them all in

the lump! A good many of the household or national divinities of the Bodo are elemental gods, chiefly rivers. Báthó, however, the chief god of the Bodo, is not an elemental god: but he is clearly and indisputably identifiable with *something tangible*, viz. the Sij or Euphorbia; though why that useless and even exotic plant should have been thus selected to type the godhead, I have failed to ascertain. Mainou or Mainong is the wife of Báthó, and equally revered with him: more I cannot learn of her. The supreme gods of the Dhimáls are usually termed Waráng-Béráng, that is, the old ones, or father and mother of the gods. They likewise are a wedded pair, whose proper names are, respectively, Pochima and Timai vel Timáng, of whom the latter is undoubtedly the Tishta river; and the former, I believe, the river Dhorla. The Bodo and Dhimáls have neither temple nor idol; and altogether their religion belongs to the same primitive era with their habits and manners, is void of offence or scandal, and if any judgment may be made of it from the manners and character of its professors, is not without beneficial influences.

I proceed now to some details upon this point, in which it will be necessary sometimes to speak separately, of the Bodo and Dhimál religions, though so little essentially distinct. This general correspondence extends not merely to the entire substance and character of the religion, properly so called, of each people, but to all minor points connected therewith; for example, both people have but a vague notion of the existence or functions of those Dii minores called Genii, Fauns, Satyrs and Sylvans by the classic ancients, and Fairies, Sprites, Gnomes, Ogres, &c. by our Gothic or Teutonic ancestors. Neither people is infested with the Gothic bugbear of ghosts, or with the Gothic and classic follies of magic, sorcery, divining, omens, auspices, astrology or fortune-telling. On the other hand, both Bodo and Dhimál alike and devoutly believe in witchcraft, of which they entertain a deep dread, and likewise in the influence of the evil eye, though much less dreaded than witchcraft. Omens are very slightly, if at all, heeded by either.

*Pantheon.*—The chief deities of the

<i>Bodo</i>	and	<i>Dhimáls.</i>
Báthó, chief god. Euphorbia or Sij plant.	The household or National gods, or Noöni Madai.	Pochima, mas. father of the gods, the river Dhorla ?
Mainou or } wife of the		Timai vel } fœm. mother of the
Báthó Búrói, } above.		Timang, } gods : the Tishta river.
Agráng, male, relative of the above pair.		Lákhim, fœm. sister of Timai with some : Mahanada ?
Khárgi, male.		Chímá, fœm. sister of Timai : the Kosi river.
Ablákhúngar, male.		Konokchiri, fœm. feeder of Konki river.
Khoílá, male, river ?		Kangkai, fœm. river Konki.
Manáshó, female. River Monás or Bonás.		Ménchi, fœm. river Mechi.
Bráí, male, river ? styled Brai or the ancient.		Sonási, mas. the Soran river.
Búí, female, river ? styled the ancient or Búroi.		Bonási, mas. the Boás or Doás.
Khandaira, male, a Rajah.		Dhúlpí, mas. the Dúbélly river.
Jaman, male, Yama of Hindus.		Danto, mas. styled the old.
Kóngar or } male, Bhutanese		Chádúng, mas. styled Rajah, son of Timai.
Góngar, } Deity.		Aphoi, mas. Rajah, son of Timai.
Jiahing, } males.		Biphoi, ditto ditto ditto.
Mishing, } males.		Aphún, ditto ditto ditto.
Dhórlabrai, mas. river, husband of Tishta.		Káphún, ditto ditto ditto.
Dúdksi, female, river.		Báphún, ditto ditto ditto.
Tishta, ditto, ditto.		Shúti, ditto ditto ditto.
Kangkai, ditto, ditto.		Rong, mas.
Ménchi, male, river.		Aika, mas. et fœm. styled the old.
Torsha, ditto, ditto.		Tairúng, } males, sons of Biphoi.
Jórdaga, ditto, ditto : the Jer-deckér R.	The Doimi madai, or River Deities.	Túirúng, }
Bálakhúngar, ditto ditto : the Bálásan.		Hili mahadóí, } Females all ;
Máhamáyá, female. River Mahananda.		Khúnchi mahadóí, } wives of the
Dóimá, Bráhma-putra. fœm. Mater magna.		Khili mahadóí, } 7 sons of Ti-
Chádúng. }		Airi mahadóí, } mai above
Gédúng. }		Birti mahadóí, } given. Ap-
Brai Bhandári. }		Nílo mahadóí, } parently Hin-
Jholou Bhandári. }		Kálo mahadóí, } du Deities,
Káthá, male, a Raja. }		newly named, or rather renam-
Dipkhúngar. }		ed by the Dhimáls.
Phorou khúngar. }		Béla, mas. the Sun.
Shyánmadai, the sun, }		Táli, fœm. the Moon.
Nokháírmadai, the moon. }		Bhanói, fœm. the Earth.
		Singko Dír, the forest gods.
		Ráko Dír, the mountain gods.
		Chambochiri, fœm. the Champa-mati river.
		Dávai chiri, fœm. river ?
		Phúl chiri, ditto ditto.



Raj phúsaró,		Male, a Penate.
Agrang kólia,		Agrang of prior list.
Khandab,		Fluviatile deities, malignant. Pi-
Jol khúnjara,	}	geons sacrificed to them.
Jol khúnjari,		
Ayá, or Ai,*	} Adopted Hin- dú gods.	
Maknar,		Kámakhya.
Jomon,		Lakshmi.
Jal kúvır,		Yama.
Thal kúvır,		
Dhon kúvır,		Kúvır, Indian Pluto.

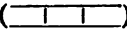
I know not that I can add any thing worth preserving to the foregoing list of the deities of the Bodo and Dhimál save what will fall more appropriately under the head of rites and ceremonies. The list might have been considerably enlarged, but chiefly by importations from the Hindu Pantheon; and as these consist of mere names, it seems sufficient to observe, once for all, that the Bodo and Dhimál have latterly adopted a good many of the Hindu goddesses, particularly the various forms of Durga or Kali, but without any of the rites appropriate to her worship, or even any images of her. The deities of the Bodo and Dhimál are divided into males and females, old and young; and the latter distinction is material as indicating the relative rank and consideration of the gods: the ancient or venerable (Brai-Baroi in Bodo, Warang-Bérang in Dhimál, according to the sex) are the Dii majores; the young (Khungar vel Jholou in Bodo, Whante in Dhimál), are the Dii minores. It will be noticed that several of the deities bear the title of Rajah; and, as one of these (Hájó) is a known historic person, it seems probable that this portion of the Bodo and Dhimál pantheon exemplifies the classic and Hindu practice of deifying the mortal benefactors of mankind—in a word, apotheosis, or hero worship. Madai, in Bodo, is a general term, equivalent to Deity, Divinity: Dír and Grám, are correspondent terms in Dhimál.

*Religious rites and ceremonies.*—The rites of the Bodo and Dhimál religions are entirely similar, and consist of offerings, sacrifices and prayers. The prayers are few and simple, when stript of their mummery; and necessarily so, being committed solely to the memories of a non-hereditary and very trivially instructed and mutable priesthood. They consist of invocations of protection for the people and their

\* Unde Ai hánó, the great festival, presently to be described.

crops and domestic animals ; of deprecations of wrath when sickness, murrain, drought, blight, or the ravages of wild animals, prevail ; and thanksgivings when the crops are safely housed, or recent troubles are passed. The offerings consist of milk, honey, parched rice, eggs, flowers, fruits, and red lead or cochineal : the sacrifices of hogs, goats, fowls, ducks, and pigeons—most commonly hogs and fowls. Sacrifices are deemed more worthy than offerings, so that all the higher deities, without reference to their supposed benevolence or malevolence of nature, receive sacrifices—all the lesser deities, offerings only. Libations of fermented liquor always accompany sacrifice—*because*, to confess the whole truth, sacrifice and feast are commutable words, and feasts need to be crowned by copious potations. Malevolence appears to be attributed to very few of the gods, though of course all will resent neglect ; but, in general, their natures are deemed benevolent ; and hence the absence of all savage or cruel rites. All diseases, however, are ascribed to supernatural agency. The sick man is supposed to be possessed by one of the deities, who racks him with pains as a punishment for impiety or neglect of the god in question. Hence, not the mediciner, but the exorcist is summoned to the sick-man's aid. The exorcist is called both by the Bodo and Dhimáls Ojhá, and he operates as follows. Thirteen leaves each with a few grains of rice upon it, are placed by the exorcist in a segment of a circle before him to represent the deities. The Ojhá, squatting on his hams before the leaves, causes a pendulum attached to his thumb by a string to vibrate before them, repeating invocations the while. The god who has possessed the sick man, is indicated by the exclusive vibration of the pendulum towards his representative leaf, which is then taken apart, and the god in question is asked, what sacrifice he requires ? a buffalo, a hog, a fowl, or a duck to spare the sufferer. He answers (the Ojhá best knows how !) a hog ; and it is forthwith vowed by the sick man and promised by the exorcist, but only paid when the former has recovered. On recovery the animal is sacrificed, and its blood offered to the offended deity. I witnessed this ceremony myself among the Dhimáls, on which occasion the thirteen deities invoked were Póchima or Waráng, Timai or Béráng, Lákchim, Konoksiri, Méchi, Chímá, Danto, Chádúng, Aphóí, Biphóí, Andhéman (Aphún), Tátópátia (Báphún) and Shúti. A Bodo exorcist would proceed precisely

in the same manner, the only difference in the ceremony being the invocation of the Bodo gods instead of the Dhimal ones.

*Festivals.*—The *great festivals* of the year are three or four. The first is held in December-January, when the cotton crop is ready. It is called Shúrkhar by the Bodo, Haréjata by the Dhimals. The second is held in February-March. It is named Wágálénó by the Bodo, who alone observe it. The Bodo name for the third, which is celebrated in July-August, when the rice comes into ear, is Phúlthépno. The Dhimals call it Gávi púja. The fourth great festival is held in October, and is named Aihúnó by the Bodo—Pochima páká by the Dhimals. The three first of these festivals are consecrated to the elemental gods and to the interests of agriculture. They are celebrated abroad, not at home, (generally on the banks of a river) whence attendance on them is call Hogron húdong, or madai húdong, ‘going forth to worship,’ in contradistinction to the style of the 4th great festival, which is devoted to the household gods, and is celebrated at home. The Wágáléno or bamboo festival of the Bodo I witnessed a year or two since, and will describe it is a sample of the whole. Proceeding from Siligori to Pankhabári with Dr. Campbell, we came upon a party of Bodo in the bed of the river, within the Saul forest, or rather, were drawn off the road by the noise they made. It was a sort of chorus of a few syllables, solemnly and musically incanted, which, on reaching the spot, was found to be uttered by thirteen Bodo men, who were drawn up in a circle facing inwards, and each carrying a lofty bamboo pole decked with several tiers of wearing apparel, and crowned with a Chour or Yak’s tail. Within the circle were three men, one of whom, with an instrument like this (  ) in his hands danced to the music, waving his weapon downwards on one side, so over the head, and then downwards on the other side and again over the head. He moved round the margin of the circle, in the centre of which stood two others, one a Deóshi, or priest, and the other an attendant or servitor, called Phantwál. The priest, clothed in red cotton, but not tonsured or otherwise distinguished from the rest of the party, muttered an invocation, whereof the burden or chorus was taken up by the thirteen forming the ring above noticed. The servitor had a water pot in one hand and a brush in the other, and from time to time, as the rite proceeded, this person moved out of the circle to sprinkle with

the holy water another actor in this strange ceremony, and a principal one too. This is the Déódá, or the possessed, who when filled with the god, answers by inspiration to the questions of the priest as to the prospects of the coming season. When we first discerned him, he was sitting on the ground panting and rolling his eyes so significantly that I at once conjectured his function. Shortly afterwards, the rite still proceeding, the Déódá got up, entered the circle and commenced dancing with the rest, but more wildly. He held a short staff in his hand, with which, from time to time he struck the bedizened poles, one by one, and lowering it as he struck. The chief dancer with the odd-shaped instrument, waxed more and more vehement in his dance; the inspired grew more and more maniacal; the music more and more rapid; the incantation more and more solemn and earnest; till at last amid a general lowering of the heads of the decked bamboo poles, so that they met and formed a canopy over him, the Déódá went off in an affected fit, and the ceremony closed without any revelation—a circumstance which must be ascribed to the presence of the sceptical strangers; for it is faith alone that worketh miracles, and only among and for the faithful. This ceremony is performed annually by the Rajah of Sikim's orders, or rather with his sanction of the usages of his subjects; is addressed to the sun, the moon, the elemental gods, and above all, to the rivers; and is designed to ensure health and plenty in the coming year, as well as to ascertain beforehand, its promise or prospect through the revelations of the Déódá. With regard to the festival sacred to the national or homebred (noñi) gods, called Aihuno by the Bodo and Póchima páká by the Dhimáls, it is to be observed that the rite, like the separate class of deities adored thereby, is more distinctively Bodo than Dhimál. With both people the pre-eminence of water among the elements is conspicuous: but, whereas the river gods of the Dhimáls have nearly absorbed all the rest, elementary or other, the household gods of the Bodo stand conspicuously distinguished from the fluviatile deities. The Prochima and Timang of the Dhimals are one or both rivers: the Báthó and Mainang of the Bodo are neither of them rivers, and their interparietal rites are as clearly distinguished from the rites performed abroad to the fluviatile and other elemental gods. However, the rites of Báthó and Mainou are *participated* by deities of elementary and watery nature, and, on the other hand, the Dhimáls assert



that Póchima and Timai have a two-fold character, one of river gods (Dhorla and Tishta), and one of supreme gods; and that they are adored, separately, in these two characters, the Póchima páká or home rite of October, being appropriated to them in the latter capacity, or that of supreme gods. \*I have not witnessed the Póchima páká, and therefore speak with hesitation. The Ai húnó\* is performed as follows. The friends and family being assembled, including as many persons as the master of the house can afford to feast, the Déóshi or priest enters the enclosure or yard of the house, in the centre of which is invariably planted a Sij or Euphorbia, as the representative of Báthó, who is the family as well as national god of the Bodo. To Báthó thus represented the Déóshi offers prayers, and sacrifices a cock. He then proceeds into the house, adores Mainou and sacrifices to her a hog. Next, the priest, the family and all the friends proceed to some convenient and pleasant spot in the vicinity, previously selected, and at which a little temporary shed has been erected as an altar, and there, with due ceremonies, another hog is sacrificed to Agráng, a he-goat to Manásho and to Búli, and a fowl, duck or pigeon (black, red, or white, according to the special and well known taste of each god) to each of the remaining nine of the Noóni madai. The blood of the sacrifice belongs to the gods—the flesh to his worshippers, and these now hold a high feast, at which beer and tobacco are freely used to animate the joyous conclave, but not spirits nor opium, nor hemp. The goddess Mainou is represented in the interior of each house by a bamboo post about 3 feet high, fixed in the ground, and surmounted by a small earthen cup filled with rice. Before this symbol is the great annual sacrifice of the hog above noted, performed; and before this, the females of the family, *once a month*, make offerings of eggs. For the males, due attention to the four annual festivals is deemed sufficient in prosperous and healthful seasons. But sickness or scarcity always beget special rites and ceremonies, suited to the circumstances of the calamity, and addressed more particularly to the elemental gods, if the calamity be drought or blight or devastations of wild animals—to the household gods, if it be sickness. Hunters, likewise, and fishers, when they go forth to the chase, sacrifice a fowl to the Sylvan gods, to promote their success; and lastly, those who have a

\* Ai or Aya, is the goddess Kámákyá or Kámrúp, vis genetrix naturæ, typed by the Bhaga or Yoni.

petition to prefer to their superiors, conceive that a similar propitiation of Jishim and Mishim, or of the Chiris, will tend to the fulfilment of their requests. And this, I think, is nearly the whole amount of rites and ceremonies which their religion prescribes to the Bodo and Dhimáls. And anxious as I am fully to illustrate the topic, I will not try the patience of my readers by describing all that variety of black victims and white, of red victims and blue, which each particular deity is alleged to prefer; first, because the subject is intrinsically trifling; and second, because the diverse statements of my informants lead me to suspect that the matter is optional or discretionary with each individual priest prescribing these minutiae. I have mentioned the rude symbols proper to Báthó and Mainou. None of the other gods seem to have any at all, though a low line of kneaded clay attached to the Tháli that surrounds the sacred Euphorbia in the yards of the Bodo is said to stand for the rest of the divinities, who, as I have already said, are wont to be worshipped collectively rather than individually; and thus the sun, the moon and the earth, though adored by Bodo and by Dhimál, have no separate rites, but are included in those appropriated to the elemental gods. Witchcraft is universally dreaded by both Bodo and Dhimál. Witches (Dain and Mháí) are supposed to owe their noxious power to their own wicked studies, or to the aid of preternatural beings. When any person is afflicted, the elders assemble and summon three Ojhás or exorcists, with whose aid and that of a cane freely used, the elders endeavour to extort from the witch a confession of the fact and the motives. By dint of questioning and of beating the witch is generally brought to confession, when he or she is asked to remove the spell, to heal the sufferer, means of propitiating preternatural allies (if their agency be alleged) being at the same time tendered to the witch, who is, however, forthwith expelled the district and put across the next river, with the concurrence of the local authorities. No other sorcery or black art save that of witches is known; nor palmistry, augury, astrology, nor, in a word, any other supposed command of the future than that described in the 'Wá galéno' as the attribute, (for the nonce) of the Déódá or vates. The evil eye cause some alarm to Bodo and to Dhimál, who call it mogon nángo and mínójó respectively, and who cautiously avoid the evil-eyed person, but cannot eject him from the

community. The influence of the evil-eye is sought to be neutralised by offerings of parched millet and eggs to Khoja Kajah and Mansha Rajah—Dii minores, who find no place in my catalogue, ample as it is. Moish madai, I am told, likewise claims a place in the Bodo Pantheon, and a distinguished place too, as the protector of this forest-dwelling people, from beasts of prey, and especially the tiger.

*Priesthood.*—The priesthood of the Bodo and Dhimáls is entirely the same, even to the nomenclature, which with both people expresses the three sorts of clergy by the terms Déóshi, Dhámi and Ojha. The Dhámi (seniores priores!) is the district priest. The Déóshi, the village priest, and the Ojha, the village exorcist. The Déóshi has under him one servitor called Phantwál. There is a Déóshi in nearly every village. Over a small circle of villages one Dhámi presides and possesses a vaguely defined but universally recognised control over the Déóshis of his district. The general constitution and functions of the clerical body have already been fully explained. Priests are subject to no peculiar restraints, nor marked by any external sign of diverse dress or other. The connexion between pastor and flock is full of liberty for the latter, who collectively can eject their priest if they disapprove of him, or individually can desert him for another if they please. He marries and cultivates like his flock, and all that he can claim from them for his services is, first, a share of every animal sacrificed by him, and second, three days' help from each of his flock (the grown males), per annum towards the clearing and cultivation of the land he holds on the same terms with them, and which have been already explained. Whoever thinks fit to learn the forms of offering, sacrifice and accompanying invocation, can be a priest; and if he get tired of the profession, he can throw it up when he will. Ojhás stand not on the same footing with Dhámis and Déóshis: they are remunerated solely by fees: but into either office—priests or exorcists—the form of induction is similar, consisting merely of an introduction by the priests or exorcists of the neophyte to the gods, the first time he officiates. One Dhámi and two Déóshis usually induct a Déóshi—three Ojhás, an Ojhá: and the formula is literally that of an introduction—‘this is so and so, who proposes, O ye gods! to dedicate himself to your service: mark how he performs the rites, and, if correctly, accept them at his hands.’

*Customs.*—Under this head I shall state the usages observed at births, naming, weaning, togavirilis, marriage and death, aggregating what is common, and distinguishing what is peculiar to the Bodo or Dhimáls. The customs of both people have a great similitude, owing to their perfect simplicity. They are derived, in fact, from nature, and nature as little strained by arbitrary devices of man as can well be. At births the mother herself cuts the navel-string, so soon as she has recovered strength for the act. No midwives are found, so that nature must do all, or the mother and offspring perish together. But deliveries are almost always very easy, and death in childbed scarcely known—a blessing derived from the active and unsophisticated manners of the sex. The idea of uncleanness occasioned by births, and by deaths also, is recognised; but the period of uncleanness and segregation is very short, and the purificatory rites consist merely of bathing and shaving, performed by the parties themselves. The infant is named immediately after birth, or as soon as the mother comes abroad, which is always in 4 or 5 days after delivery. There are no family names, or names derived from the gods. Most Bodo and Dhimáls bear meaningless designations, or any passing event of the moment may suggest a significant term: thus a Bhótia chief arrives at the village and the child is called Jinkháp; or a hill peasant arrives, and it is named Góngar, after the titular or general designation of the Bhótias. Children are not weaned so long as their mother can suckle them, which is always from two to three years—sometimes more—and two children, the last and penultimate, are occasionally seen at the breast together. The delayed period of weaning will account in part for the limited fecundity of the women. When a Bodo or Dhimál comes of age, the event is not solemnised by any rite or social usage whatever. Marriage takes place at maturity, the male being usually from 20 to 25 years of age, and the female, from 15 to 20. Courtship is not sanctioned: the parents or friends negotiate the wedlock, though in so simple a state of society it cannot be, but the parties have frequently met and are well known to each other. The Hindús wisely and decorously attach much discredit to the parent, who takes a “consideration” for the grant of his daughter in marriage. No such delicacy is recognised by Bodo or Dhimál parents, who invariably demand and receive a price, which is called Jan in the language of the former, and Gándi in that of the latter people. The amount varies

from 10 to 15 rupees among the Dhimáls, from 15 to 45 among the Bodo. I cannot learn the cause of the great difference. A youth who has no means of discharging this sum, must go to the house of his father-in-law elect and there literally earn his wife by the sweat of his brow, labouring, more judaico, upon mere diet for a term of years, varying from two as an average, to five and even seven as the extreme period. This custom is named Gaböi by the Bodo—Ghárjyá by the Dhimáls. It, of course, implies a good deal of intercourse between the betrothed youth and damsel prior to their nuptials; but from all I can learn, instances of opportunity abused are most rare. The legal nature and effects of the nuptial contract have been already explained under the head of laws: what concerns fecundity, longevity, &c. under the head of medicine, as a branch of religion. The marriage ceremony is little perplexed with forms. After the essential preliminaries have been arranged, a procession is formed by the bridegroom elect and his friends, who proceed to the bride elect's house, attended by two females specially appointed, to put red lead or oil on the bride elect's head, when the procession has reached her home. There a refection is prepared, after partaking of which the procession returns, conducting the bride elect to the house of the groom's parents. So far, the same rite is common to the Bodo and Dhimál—the rest is peculiar to each. Among the Dhimáls, the Déóshi now proceeds to propitiate the gods by offerings. Dáta and Bídata, who preside over wedlock, are invoked, and betel leaf and red lead are presented to them. The bride and groom elect are next placed side by side, and each furnished with five panna, with which they are required to feed each other, while the parents of the groom cover them with a sheet, upon which the Déóshi, by sprinkling holy water sanctifies and completes the nuptials. Among the Bodo the bride elect is anointed at her own home with oil; the elders or the Déóshi perform the sacred part of the ceremony, which consists in the sacrifice of a cock and a hen, in the respective names of the groom and bride, to the sun; and next, the groom, rising makes salutation to the bride's parents, and the bride, similarly attests her future duty of reverence and obedience towards her husband's parent; when the nuptials are complete. A feast follows both with Bodo and Dhimáls, but is less costly among the former than among the latter—as is said, because the higher price paid for his wife by the

Bodo incapacitates him for giving so costly an entertainment. The marriage feast of the Dhimáls is alleged to cost 30 to 40 rupees sometimes, the festivities being prolonged through two and even three days ; whereas 4 to 6—rarely 10 rupees, suffice for the nuptial banquet of a Bodo.

The Bodo and Dhimáls both alike bury the dead immediately after decease, with simple but decent reverence, though no fixed burial ground nor artificial tomb is in use to mark the last resting place of those most dear in life, because the migratory habits of the people would render such usages nugatory. The family and friends form a funeral procession, which bears the dead in silence to the grave. The body being interred, a few stones are piled loosely upon the grave to prevent disturbance by jackals and rats, rather than to mark the spot, and some food and drink are laid upon the grave ; when the ceremony is suspended and the party disperses. Friends are purified by mere ablution in the next stream, and at once resume their usual cares. The family are unclean for three days, after which, besides bathing and shaving, they need to be sprinkled with holy water by their elders or priest. They are then restored to purity and forthwith proceed to make preparations for a funeral banquet, by the sacrifice of a hog to Mainou or Timáng, of a cock to Báthó or Pochima, according to the nation. When the feast has been got ready and the friends are assembled, before sitting down, they all repair once again to the grave, when the nearest of kin to the deceased, taking an individual's usual portion of food and drink, solemnly presents them to the dead, with these words, ' take and eat : heretofore you have eaten and drank with us : you can do so no more : you were one of us : you can be so no longer : we come no more to you : come you not to us.' And thereupon the whole party break and cast on the grave a bracelet of thread priorly attached, to this end, to the wrist of each of them. Next the party proceed to the river and bathe, and having thus lustrated themselves, they repair to the banquet, and eat, drink and make merry as though they were never to die ! A funeral costs the Dhimáls from four to eight rupees—something more to the Bodo, who practise more formality on the occasion, and to whom is peculiar the singular leave-taking of the dead just described.

*Useful Arts.*—As already observed, the arts practised by the

Bodo and Dhimáls are few, simple and domestic. Agriculture is the grand and almost sole business of the men, but to it is added the construction and furnishing of the dwelling house in each of the frequent migrations of the whole people. The boys look after the domestic animals. The women, aided by the girls, are fully employed within doors in spinning, weaving and dying the clothing of the family, in brewing, and in cooking. The state of the arts will be sufficiently and most conveniently illustrated by a description of the household furniture, clothes, food and drinks of the people, preceded by an account of the implements, processes, and products of agriculture.

*Agriculture.*—The agricultural implements are an ax to fell the forest trees, a strong bill or bill-hook to clear the underwood and also to dig the earth, a spade for rare but more effectual digging, and lastly a dibble for sowing the seed. The ax is called Rúa by the Bodo, Dúphé by the Dhimáls. It is a serviceable implement of iron (the head) similar to that in use in the plains where the head is bought; the haft being made at home. The bill, called Chékhá by the Bodo, Ghongóĩ by the Dhimáls, is a "jack of all work," like in shape to our English bill, but with the curved extremity or beak prolonged and furnished with a straight downward edge of some three inches. It is of iron, of course, and purchased in the Kócc̄h marts. The spade is the ordinary short, bent one of the plains, where it is bought, and where it is called Kódál. The Bodo and Dhimáls use it but little, and have no name of their own for it. The dibble is a wooden staff about 4 feet long, made by the people themselves. It is like a stout walking staff sharpened at the lower end. The process of culture, emphatically called 'clearing the forest,' is literally such for the most part, and would be so wholly, but that several of the species grown being biennials, a field is retained over the first year, so that the second year's work consists merely of weeding and resowing rice amid the other standing products. The characteristic work is the clearing of fresh land, which is done every second year, and thus, axes and bills clear away the wood: fire completes what they have left undone, and at the same time spreads over the land an ample stratum of manure (ashes); the soil is worked nearly enough in eradicating the undergrowth of trees (for the lords of the forest are only truncated); so that what little additional digging is needed, may be and is performed with the square

end of the bill. 'Tis no great matter, and firing is the last *effectual* process. Amid the ashes the seed is sown by a dibbler and a sower, the former of whom, walking erect, perforates the soil in quincunxes by sharp strokes of his pointed staff, (called *Shóman* by the Bodo and *Dhúmsi* by the *Dhimáls*) so as to make a series of holes from one to two inches deep, and about a span apart; whilst the latter, following the dibbler, and furnished with a basket of mixed seeds, drops 4 to 6 seeds into each hole and covers them at the same time. All the various produce raised is grown in this promiscuous style. Chait, Baisákh and half Jeth,\* comprise the season for preparing and sowing the soil. Sáwan, Bhádún, Kúár and half Kártik,† that for gathering the various products, save cotton, which is not gathered till Pús-Mágh.‡ The rest are reaped as they successively ripen: first cucurbitaceous plants (Kóhara, Louka, Khíra, Kankara Karelá); then greens (Sem, mattar, Bengan, Chichinda, Póí); then the several edible roots (Yam, Arwi, &c.); then the condiments (Haldi, Adrak, red peppers); then the millets and pulse (Marwa, Kúlthi, Urid); then Maize; next rice; then the mustards (Tori or Sarsún or Til), and last of all, cotton. The fields, which are much better worked in eradicating the jungle than those for which the Bengal plough performs the same office, are likewise as much better weeded; and how strange soever to mere English ears, the huge mixture of crops may sound, this mixture does not greatly exceed the practice of Bengal, nor is it inconsistent with good returns, though there be no artificial irrigation whatever. The cotton is a biennial of inferior quality, but it is the main crop, and that from the sale of which in the plains, the Bodo and *Dhimáls* look to provide themselves with the greatest part of the rice they consume; for their own supply is very inadequate. Nevertheless rice is usually spoken of as the crop next in estimation to cotton, though maize and even millet seem to contribute as much to the quantity of home-reared food. The rice grown is similar to the "dry rice"—"the Ghaia" of Nepal—the "summer rice" of the plains. The other articles grown, have all been enumerated above, save Indigo, which, with the cochineal of the forest, and Madder procured from the hills, supplies the Bodo and *Dhimáls*

\* March, April, and May respectively.

† July, August, Sept. and Oct. respectively.

‡ December, January.



with dyes. Arhar and a few more of the superior agricultural and horticultural products of the plains are occasionally grown by the Bodo and Dhimáls, whose chief products, however, are those given above, and of them not absolutely all in one field and year, though from 12 to 15 are always there, and include a good supply of vegetables, condiments and cerealea, but the last deficient in the article of rice, which is the principal grain eaten. Of vegetables the favorites are Bégans, cucurbitacea and roots (Thá vel Kin, in their own tongues) : of cereals, rice : of condiments, red peppers. Mustards are grown not for their oils, nor as stimulants, but merely for eating like parched peas. The oil seeds are fried and are relished in that state :\* the young plants also are used as greens. The surplus seed is sold to the oilmen of the plains, neither Bodo nor Dhimál being wont to express oil, of which they consume little, and that only for cooking. Lights they use none (save on occasions of ceremony and of púja) but go to bed early and sit by the fire—a splendid wood fire—till then. The small quantity of oil used for cooking they buy in the adjacent marts of the Kócch. The cotton crop and the surplus of the mustard crop, are all the agricultural products which they sell any portion of. Cotton is habitually sold, the small portion only that is needed for clothing the family being reserved, which may be about one-fifteenth of what is raised. The domestic animals have been enumerated elsewhere, and must be spoken of again when we come to the head of food. Agriculturally viewed, they are a dead letter, not even their manure being employed.

Upon the whole the agriculture of the Bodo and Dhimáls is conducted with as much skill as that of their lowland neighbours ; with skill superior much to that of their highland neighbours ; and with pains and industry greatly above those of either highlanders or Kócches. The following details of what is raised by one Bodo cultivator, and consumed by himself, his wife and three young children, imperfect though they be, will help to convey a just idea of his position.

Bodo peasant tilling about  $1\frac{1}{2}$  bigha with the spade.

\* They are fried with greens, and of course yield up a good deal of their oil to flavour the vegetables.

## PRODUCTS OR INCOME.

Dhán or rice in husk,..	24 bisi = 12 maunds =	4	0	0
Cotton undressed,.....	16 bisi = 8 maunds =	32	0	0
Maize, .....	3 bisi = 1½ maunds =	0	8	0
Millets and Pulse,.....	4 bisi = 2 maunds =	0	12	0
Condiments, dyes & greens	2 bisi = 1 maund =	4	0	0
Total Rupees, ..		41	4	0

## EXPENSES.

Rice in husk, bought, 3 Pouthi = 48 maunds	=	15	0	0
Salt bought, 18 Phol = 18 seers	=	3	0	0
Cotton field pujá,.....	=	1	0	0
Government tax, .....	=	1	0	0
Cotton seed bought,.....	=	1	0	0
Ai huno festival, .....	=	3	0	0
Oil bought for worship and for occasional lights,..	=	0	8	0
Sickness, fees to the Ojhá, .....	=	4	0	0
Presents to sisters and friends who ask aid and make visits, ..	=	2	0	0
Ornaments for wife,.....	=	2	0	0
Fruits bought for self, wife and children,.....	=	2	0	0
Fish bought in rains when none can be taken in the forest, .....	=	1	8	0
Earthen vessels bought, ....	=	0	8	0
Proportion of price of Chékhá or Bill, .....	=	0	8	0
Ditto ditto of Jong or spear, .....	=	0	8	0
Ditto ditto of metallic pots and pans,.....	=	0	8	0
Sundries, .....	=	2	0	0
Total Rupees, ..		40	0	0

Balance in favour,..... 1 4 0

It has been already mentioned that the Bodo and Dhimal peasant is liable to a corvee or labour tax, the items of which may be added thus—for the Rajah 3 days, thrice a year or 9 days—for the Rajah's local representative, 6 days—for the village priest or Déóshi, 3 days—Total 18 days per annum. This is so much deducted from his resources, and

may be stated at 2\* rupees in coin. A peasant of the plains, using the plough, will earn twice or even thrice as much as a Bodo or Dhimál, and yet, what with the wretched system of borrowing at 25 to 30 per cent. and the grievous extra frauds incidental to that system, he will not be nearly so well off. The Bodo or Dhimál again, has abundance of domestic animals, and is moreover at liberty to eat the flesh of all save the cow, whereas the peasant of the plains has few, and of those only the goat that he can eat. And, lastly, the Bodo's industrious wife not only spins, but weaves and dyes all the clothes of the family, besides supplying it amply with wholesome and agreeable beer, whilst the peasant's wife in the plains does nothing but spin; and though this may diminish the cost of the family clothing, still it must be bought, nor will there be much thread to dispose of in free sale, apart from the clothier. The highland peasantry, generally, earn less than the Bodo and Dhimáls, and are proportionally worse off, though lightly taxed and exempt from the curse of the borrowing system. The Newár peasants of the great valley of Nepal,—as industrious as the Bodo and Dhimáls—nay more so—and more skilful too,—earn more and retain more notwithstanding the heavy *rent* they pay to their landlord, who pays the light tax or Government demand on the land.

*Houses.*—The Bodo and Dhimáls build and furnish their own houses without any aid of craftsmen, of whom they have none whatever. They mutually assist each other for the nonce, as well in constructing their houses as in clearing their plots of cultivation, merely providing the helpmates with a plentiful supply of beer. A house is from 12 to 16 cubits long by 8 to 12 wide; a smaller house of the same sort is erected opposite for the cattle, and if the family be large, two other domiciles like the first are built on the other sides, so as to enclose an open quadrangle or yard. The houses are made of jungle grass secured within and without by a trellice work of strips of bamboo. The roof has a high and somewhat bulging pitch, and a considerable projection beyond the walls. It also is made of wild grass, softer than that which forms the walls. There is only one division of the interior which separates the cooking and the sleeping portions of the house, which has no chimney or window, and but one door. Ten to forty such

\* If the Bodo pay one rupee of direct and two of indirect taxes, he will be nearly on a level, quoad public burdens, with the peasant of the plains.

houses form a village, without any rigid uniformity or any defences whatever.

*Furniture* is very scant, consisting only of a rare bedstead, some sleeping mats, a stool or two, and some swinging-shelves; and all of these are made at home. Household utensils are a few earthen vessels for carrying and holding water, some metallic cooking, eating, and drinking pots, and a couple of knives, to which we must add the spinning, weaving, dyeing, and brewing apparatus of the women. All the latter are of the simplest possible form and homemake: the earthen and metallic pots and pans are purchased in the Kócc h marts. There are none of iron nor of copper; all are of brass or of other mixed metals that are metallic, owing, it is said, to the dearth of iron and copper. There are no leathern utensils. Baskets of bamboo and of cane and ropes of grass, are abundant and of homemake, by the men who likewise haft all the iron implements they purchase abroad, for agricultural or domestic uses. It has already been said that lights are dispensed with beyond what is afforded by an ample fire.

*Clothes.*—With both people they are made at home and by the women. The Bodo women wear silk procured from the castor plant worm, which they rear at home in each family. The Bodo men and Dhimáls of both sexes wear cotton only. Woollen is unknown, even in the shape of blankets. The manufactures are durable and good, and not inconveniently coarse—in fact, precisely such as the people require: and the dying is very respectably done with their own cochineal, morinda, or indigo, or with madder got from the hills—but all prepared by themselves. The female silk vest of the Bodos possessed by me is  $3\frac{1}{2}$  feet wide by 7 long, deep red, with a broad, worked margin of cheque pattern—and of white and yellow colours, beside the ground red—above and below. This garment is called Dókhana by the Bodo, and must be a very comfortable and durable dress, though it somewhat disfigures the female form by being pressed over the breast as it is wrapped round the body, which it envelopes from the armpits to the centre of the calves. The female garment of the Dhimáls differs only in material, being cotton. It is called Bónha. The male dress of the Bodo consists of two parts—an upper and a lower. The former is equivalent to the Hindu chadar or toga. It is called Shúmá, and is 9 to 10 cubits by 3. The latter, styled Gámchá, and which is 6 cubits by 2, is equivalent to the Hindu

Dhoti, and after being passed between the legs is folded several times round the hips and the end simply tucked in behind. The male dress of the Dhimáls is similar: its upper portion is called Pátaka—its lower, Dhári—the whole, Dhába with this people—Hí with the Bodo. All cotton clothes, whether male or female, are almost invariably white or undyed. Neither Bodo nor Dhimál commonly cover the head, unless when the men choose to take off their upper vest and fold it round the head to be rid of it. Shoes are not in use; but a sort of sandals or sole-covers, called Yápthong vel Champoi, sometimes are, and are made of wood by the people themselves. There are no other shoes. Ornaments are rare, even amongst the women, who however wear small silver rings in their ears and noses also, and heavy bracelets of mixed metal on their wrists. These are bought in the Kócch marts, and are quite simple in form.

*Food.*—The sorts of vegetable food have been already enumerated in speaking of agriculture; rice is the chief article: wheat or barley, unknown even by name. Ghin or clarified butter, is likewise totally unused and unnamed, and oil is very sparingly consumed for food. Salt, chillies, vegetables, plenty of rice, varied sometimes with maize or millet, and fish or flesh every second day, constitute, however, a meal which the poor Hindu might envy, washed down as it is with a liberal allowance of beer. Plenty of fish is to be had from December to February, both inclusive, and plenty of game from January to April inclusive, though the Bodo and Dhimál are no very keen or skilful sportsmen, notwithstanding the abundance of game and freedom from all prohibitions. They have the less need to turn hunters in that their domestic animals must supply them amply with flesh. They have abundance of swine and of poultry, and not a few of goats, ducks and pigeons, but no sheep nor buffaloes, and cows are scarce; milk is little used, but not eschewed, as by the Gárós it is. They may eat all animals, tame or wild, save oxen, dogs, cats, monkeys, elephants, bears and tigers. Fish of all sorts, land and water tortoises, mungoes, civets (not cats!), porcupines, hares, monitors of enormous size, wild hogs, deer of all sorts, rhinoceros, and wild buffaloes, are amongst the wild animals they pursue for their flesh; and altogether they are abundantly provided with meat.

*Drinks and stimulants.*—The Bodo and Dhimáls use abundance of a

fermented liquor made of rice or millet, which the former call Jó, the latter, Yú. It is not unpleasant, and I should think was very harmless. Its taste is a bitterish subacid, and it is extremely like the Ajimana of the Népáls of Nepal. Brewing and not distilling, seems to be a characteristic of nearly all the Tamulian races, all of whom drink and make beer—and none of them, spirits. The Bodo and Dhimál process of making this fermented liquor is very simple : the grain is boiled : the root of a plant called Agaichito is mixed with it : it is left to ferment for two days in a nearly dry state : water is then added, quant. suff. ; the whole stands for 3 or 4 days, and the liquor is ready. The Agaichito plant is grown at home : its root, which serves for balm, is called Emon. I have never seen it. Besides this beer—of which both people use much—they likewise freely use tobacco ; but never opium nor hemp in any of the numerous preparations of both ; nor distilled waters of any kind ; and upon the whole, I see no reason to brand them with the name of drunkards, though they certainly love a merry cup in honour of the gods at the high festivals of their religion. Among my own servants the Bodo have never been seen drunk : the Moslems and Hindús, several times excessively so.

*Manners.*—The manners of the Bodo and Dhimáls are, I think, a pleasing medium between the unsophisticated roughness of their highland neighbours, and the very artificial smoothness of their neighbours of the plains. They are very shy at first ; but when you know them they are cheerful without boisterousness and inquisitive without intrusion. Man's conduct to woman is always one of the best tests of his manners : now the Bodo and Dhimáls use their wives and daughters well ; treating them with confidence and kindness. They are free from all out-door work whatever ; and they are consulted by their husbands as their safest advisers in all domestic concerns, and in all others that women are supposed likely to understand. When a Bodo or Dhimál meets his parent or one of the elders of the community, he drops his joined hands to the earth, and then raises them to his forehead ; and if he be abroad he says ' father, I am on my way,'—to which the parent or senior answers, ' may it be well with you.' There is little visiting save that which is inseparable from the frequent religious feasts and festivals, already sufficiently described, nor are amusements or pastimes for young or old common. Indeed, children or

women seem to have none, and the men so little heed them, that neither the Bodo nor Dhimál tongue has a word of its own for sport, play or game! The young men, however, have two games, which I proceed to describe summarily. In the light half of October, on the day of the full moon, a party of youths proceed at nightfall from village to village, like our Christmas-wakers, hailing the inhabitants with song and dance, from night till morn, and demanding largess. This is given them in the shape of grain, beer and cowries, wherewith on their return they make a feast, and thus ends the pastime, which is called Harna-harni by the Bodo, and Harna-dháká by the Dhimáls. Again, in the dark half of the same month, when the wane is complete, the youths similarly assemble, but in the daytime, and dressing up one of their party like a female, they proceed from house to house and village to village, saluting the inhabitants with song and dance, and obtaining presents as before, conclude the festival with a merry making among themselves. The Bodo name of this rite or game is Chórgéléno—the Dhimáls call it Chórdháká. And now we shall conclude the subject of manners with a statement of the ordinary manner in which a Bodo or Dhimál passes the day. He rises at day spring, and having performed the offices of nature and washed himself, he proceeds at once to work in his field till noon. He then goes home to take the chief meal of the day, and which consists of rice, pulse, fish or flesh (on alternate days), greens and chillies, with salt—never ghiu—seldom oil. He rests an hour or more at noon, and then resumes his agricultural toils, which are not suspended till night-fall. So soon as he has got home, he takes a second meal with his family—then chats a while over the fire, and to bed betimes—seldom two hours after dusk. If the children be young, they sleep with their parents—if older, apart. The Bodo call their first meal Sanjúphúni inkhám—their second, Bílíni inkhám. The Dhimál name for the first is Mánjbéla-cháká; for the second, Dilima-cháká. Wives usually eat after their husbands—children with.

*Character.*—The character of the Bodo and Dhimáls, as will be anticipated from the foregoing details, is full of amiable qualities—and almost entirely free from such as are unamiable. They are intelligent, docile, free from all hard or obstructive prejudices, honest and truthful in deed and word, steady and industrious in their own way of life; but apt to be mutable and idle when first placed in novel situations, and to

resist injunctions, injudiciously urged, with dogged obstinacy. They are void of all violence towards their own people or towards their neighbours, and though very shy of strangers, are tractable and pleasant when got at, if kindly and cheerfully drawn out. The Commissioner of Assam, Major Jenkins, who has by far the best opportunities for observing them, *when drawn out of their forest recesses*, gives them, as we have seen, a very high character as skilful, laborious cultivators, and peaceable respectable subjects; whilst that this portion of them want neither spirit nor love of enterprise, is sufficiently attested by the fact, that when the Dorjiling corps was raised two-thirds of the recruits first obtained were Bodo of Assam. Neither the Bodo nor Dhimál however, can be characterised, upon the whole, as of military or adventurous genius, and both nations decidedly prefer, and are better suited for the homebred and tranquil cares of agriculture. They are totally free from arrogance, revenge, cruelty and fierté; and yet they are not devoid of spirit, and frequently exhibit symptoms even of that passionate or hasty temperament, which is so rare, at least in its manifestations, in the east. Their ordinary resource against ill-usage is immoveable passive resistance: but their common demeanour is exempt from all marks of the wretched alarm, suspicion and cunning that so sadly characterise the peasantry of the plains in their vicinity, and which, being habitual, must be fatal to truth. The Bodo and Dhimál in this respect, as in most others, more nearly resemble the mountaineers, whose straight-forward manly carriage so much interests Europeans in their favour. Oppression and its absence beget these different phases of character. The absence of all petty trade likewise contributes materially to the candour and integrity of the Bodo and Dhimáls. Among all mankind, women, wine, and power are the great tempters, the great leaders astray. Now the Bodo and Dhimáls rise decidedly superior to the first temptation; are not unduly enslaved to the second; and, from the perfect equality and subject condition of the whole of them, are entirely exempted from the third. Power cannot mislead those who never exercise it: where women are esteemed and no artificial impediments whatever exist to prevent marriage, women are a source, not of vice, but of virtue: and, lastly, where "honest john barley corn" is free from the dangerous alliance of spirits, opium and hemp, I know not that he, even if assisted by the "narcotic weed," need be set down as a



necessary corrupter of morals. True, the Bodo and Dhimál do not pretend to the somewhat pharisaical abstemiousness or cleanliness of the Hindús. But I am not therefore disposed particularly on Hindú evidence, to tax them with the disgusting vices of drunkenness and dirtiness, though these, and obstinacy, *if any*, are the vices we must lay to their charge, as the counterpoise of many and unquestionable virtues. Peasant, be it remembered, must be compared with peasant, and not peasant with people of higher condition; and if the comparison be thus fairly made, it may perhaps be truly decided, that the Bodo and Dhimál are *less* sober and *less* cleanly and *less* tractable than the people of the plains—*more* sober and *more* cleanly and *more* tractable than those of the hills. The Bodo and Dhimáls are good husbands, good fathers and not bad sons; and those who are virtuous in these most influential relations, are little likely to be vicious in less influential ones, so that it need excite no surprise that these people, though dwelling in the forest, apart from the inhabitants of the open country, are never guilty of black mailing or dacoity against them, whilst among themselves crimes of deep dye are almost unknown. To the ostentatious hospitality of many nations whose violence against their neighbours is habitual, they make no pretensions; but among their own people they are hospitable enough, and towards the stranger, invariably equitable and temperate.

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PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL,  
FOR JULY, 1849.

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At a meeting of the Asiatic Society held on Wednesday, the 4th July, 1849.

The Hon'ble Sir J. W. COLVILLE, President, in the chair.

The proceedings of the June meeting were read and confirmed, and the accounts and vouchers of the preceding month were laid upon the table.

*Robert Cathcart Dalrymple Bruce*, H. M. S. who had been duly proposed and seconded at the June meeting, was ballotted for and elected.

The following gentlemen were proposed for election at the August meeting:—

*Arthur Grote*, Esq. B. C. S. proposed by Dr. Falconer, seconded by Mr. R. W. G. Frith.

*Doctor Martin*, proposed by Mr. F. P. Strong, seconded by Capt. Latter.

Read letters—

From W. Seton Karr, Esq., under Secretary to the Government of Bengal, presenting for the use of the Museum of Economic Geology, a Map of the district of Patna.

From E. Madden, Esq. forwarding Supplementary Notes to his article entitled "The Turree and Outer Mountains of Kumaon," which appeared in the Society's Journal for May and June, 1848.—(Ordered to be printed in the Journal.)

From James Hume, Esq. Honorary Secretary to the Agricultural and Horticultural Society of India, forwarding some specimens of iron ore

from the banks of the Damooda, for the Museum of Economic Geology, and requesting the opinion of the Society thereon.—(Referred to the Curator, Museum of Economic Geology.)

From Captain M. Kittoe, forwarding a transcript of an inscription cut on a thick brick, found in a field near Jaunpoor, and strongly advising the Society to send him all the old Copper Plates now in the Museum for re-transcription and classification. Capt. Kittoe continues,—

“Having, while on my recent tour heard of a fine pillar at Pahladpoor, near Jhagupoor, I sent my inscription hunters to examine it. It is the same pillar which Major Burt brought to Mr. Prinsep’s notice just as our lamented friend was leaving for Europe. The Major only sent an impression, of the single line, which occurs about midway on the pillar, and this impression was mislaid. I have now several copies before me, and moreover two or more of the “shell pattern,” only most highly ornamented, with dragon-like flourishes, and a sentence to each in the Thibetan Sanscrit character, which I here enclose.\* You will observe that there are six syllables, so are there six shells. But Thibetan writing is within the scrolls or dragons of the shell pattern.

The pillar is apparently a pillar of victory of some Kshetri prince, whose name is unfortunately effaced. The character is that found in the caves of Western India, given by Col. Sykes and Mr. Wathen. I have no pure copies of the shells, or I would have sent them. Mr. Laidlay has most ingeniously guessed at the meaning, and supposes the words to be Aum mané padma hom, but here the six syllables are differently expressed, in the Thibetan, and in two ways.

From the position of Pahladpoor, some inclined to think it has been the “Temple of the vast solitude of Fa Hian.” Referred to the Oriental Section.

From Dr. E. Roer, Secretary Oriental Section, returning Captain Ellis’s letters and their enclosures, and intimating the Section’s opinion that the questions therein contained should be translated into English, and the most interesting ones printed in the Journal. Also submits a translation of the questions for the information of the Society.

From the same—forwarding the following extracts of letters from European scholars with regard to the publication of the Vedas.

\* These have not yet come to hand; we shall be very glad to receive them.  
—Eds.

*Extract of a letter from Dr. MULLER, dated the 23rd April, 1849.*

"Your edition of the Brihad Aranya Upanishad, at least the first four numbers, has arrived in England, but I have been of late so busy that I had as yet no time to read it. At any rate, it is delightful to have all the material so near at hand, and I hope that the *Bibliotheca Indica* will remain an inexhaustible mine for the Sanskrit.

Now in Europe we'll be able to publish the Taittirīya Sanhitā or Brāmhana. Of the first there is only one MS. containing 7 Ashtakas, in Colebrooke's collection, and a portion of the commentary to the 7th Ashtaka; and there is no complete copy of the Taittirīya Brāmhana. I believe, however, it is the same with the Āpastamba Brāmhana, of which three books are in Colebrooke's collection. If you will do service to the Sāma Veda, why not publish the Tāndya Brāmhana?"

*Extract from a letter of Dr. WEBER of Berlin, dated 27th Jan. 1849.*

"A publication of the 50 Upanishads, translated by Anquetil, would be of much greater importance. Only five of them have as yet been printed, viz. Kēna, Isā, Kāthaka, Mundaka, and the Brihad Aranyakā in the Kamvasākha. (Bonn, 1844, by Poley). The Chandōgya Upanishad is being prepared for the press since some years already by Windishmann; but many years may still elapse, before it will be printed. The work, however, whose publication is of the greatest importance, is the Taittirīya Yajur. I have examined the libraries in England, in Paris and here, and may assure you, that an edition of the Yajur is impossible in Europe. With reference to this I have written a small paper, which will appear in the next number of Lassen's Journal. According to your advice I wrote to the Societies in Bombay and Madras with regard to my edition of the white Yajur, and took at the same time the liberty of requesting them to look out for MS. of the Taittirīya Yajur, and to transmit them to you. There are at any rate MSS. of the commentary of Sāyana in Benares, as I have read in the Journal of your Society. About 230 pages of the white Yajur have been printed, and the first volume, containing 320 pages, will be published at the commencement of April (in London, at Williams' and Norgate, at 21 shillings).

Rev. Benfey in Goettinger HAS PUBLISHED a most excellent edition of the Sāma Sanhitā, with gloss, translation and a copious introduction. The 7—12 books of Roths' *Nirukta* may soon be expected. Lassen writes to me, that a further portion of his Indian Antiquities, containing Indian history to Vikramaditya, will probably appear about Easter. Stewgler prepares an edition of Yajnavalkya, which is to be ready at the same time. Trithem in Oxford has lately published Bhavabhūti's Uttara Rāma Charitra. Mueller's

Rig Veda amounts already to 640 pages. The first volume will appear about Easter. Boethlinck in Petersburg is busy with Tibetan and Jakútan studies. Professor Brockhaus publishes Burnouf's *Vendidad Sade* in Latin characters, together with a complete glossary, which will make the Zend accessible to the learned."

*Extract from a letter of Professor LASSEN.*

"I hope the Society have received the second part of my Indian Antiquities. The second volume is now printing, and pretty far advanced. I trust, I shall have finished within the next two months the first part of this volume, containing the history till Vikramaditya. This part of Indian history is one of the most interesting, as we have so exact records on the history of Alexander, and as there is so rich a source of information in the inscriptions of Asóka, which in my opinion are hitherto not properly made use of.

The following information on the progress of the labours relative to Védaic literature may be interesting to you; the first volume of Mueller's Rig Véda is nearly completed. Weber in Berlin publishes the white Yajur with a commentary of Mádhava. Dr. Aufrecht at Berlin is occupied with the preparatory labours of an edition of the Atharva. We may therefore hope, that in a short time the Véda, in the strict sense of the word, with the exception of the black Yajur, will be published. There are, however, several works of importance, necessary for its explanation, still to be published, by the edition of which the Asiatic Society would do a great service to Védaic literature."

From Rev. Mr. Mackay, requesting a copy of the Asiatic Researches and some parts of the Journal, for the Free Church Institution.

Ordered that the Society regret that they are unable to grant the request, as it is contrary to the rules of the Society.

From Capt. J. D. Cunningham, "Note on the Limits of Perpetual Snow in the Himalayas." (Ordered to be printed in the Journal).

From Captain Thos. Hutton—"Notices of some Land and Fresh water shells occurring in Afghanistan." (Ordered to be printed in the Journal).

From J. W. Laidlay, Esq. V. P. "Comparative Vocabulary of the Sghá and Pghó dialects of the Karens; with observations on the grammatical peculiarities of those languages." (Ordered to be printed in the Journal).

From H. Piddington, Esq. examination of a new mineral, Haughtonite.

From the same—Catalogue of Presentations, Geological, Paleontological and Minerological.

Read Report of the Curator of the Museum of Economic Geology, for the month of June.

(True Copy)      J. W. COLVILE, *President*.  
J. W. LAIDLAY, *Sec.*

#### LIBRARY.

The following books have been received since the last meeting :—

#### *Presented.*

The Journal of the Indian Archipelago, for May, 1849.—PRESENTED BY THE GOVERNMENT OF BENGAL.

The Calcutta Christian Observer, for July, 1849.—BY THE EDITORS.

Upadeshaka, No. 31.—BY THE EDITOR.

The Oriental Baptist, No. 31.—BY THE EDITOR.

Meteorological Register kept at the Surveyor General's Office, Calcutta for the month of May, 1849.—BY THE DEPUTY SURVEYOR GENERAL.

A discourse delivered at the Hindu College on the Hare Anniversary, Friday, June 1st, 1849. By the Rev. K. M. Banerjea.—PRESENTED BY BABU PEARYCHAND MITTRA.

#### *Purchased.*

The Edinburgh Review, Nos. 167, 170, 171 and 180.

The Calcutta Review, Nos. VI. VII. X. XI. and XXII.

Comptes Rendus, Nos. 10 and 12.

The Annals and Magazine of Natural History, No. XVI.

Illustrations of Indian Ornithology. By T. C. Jerdon, Esq. No. IV. (2 copies).

#### *Donation to the Museum.*

A Portrait of Henry Torrens, Esq. B. C. S. Presented by F. C. Lewis, Esq.; forwarded by Mr. Taylor.

*Meteorological Register kept at the Surveyor General's Office, Calcutta, for the Month of July, 1849.*

Observations made at sunrise.										Maximum Pressure observed at 9h. 30m.										Observations made at apparent noon.									
Date.	Temperature.				Wind.	Aspect of Sky.	Bar. P. red. to 32° F.	Temperature.				Wind.	Aspect of Sky.	Bar. P. red. to 32° F.	Temperature.				Wind.	Aspect of Sky.									
	Of Mer.	Of Air.	W. Bulb.					Of Mer.	Of Air.	W. Bulb.					Of Mer.	Of Air.	W. Bulb.												
18	Inches	78.0	78.7	76.8	N. W.	Cloudy.	29.523	83.3	81.8	78.3	S. E.	Cloudy.	29.493	87.0	85.8	79.7	S. W.	Cumulo strati.											
2	.484	78.8	79.3	77.6	S. E.	Ditto	.563	83.2	82.4	78.9	S. S. E.	Cumulo strati.	.554	85.2	84.5	80.2	S. W.	Ditto											
3	.595	79.2	79.8	78.7	S. E.	Cumuli.	.631	90.6	88.0	81.5	S. E.	Ditto	.589	89.3	81.6	80.9	S. W.	Ditto											
4	.594	80.3	81.0	79.5	S. S. E.	Cirro strati.	.623	87.3	85.9	81.4	S. W.	Ditto	.590	92.2	90.5	82.5	S. W.	Ditto											
5	.584	80.4	81.0	79.3	S. S. W.	Ditto	.602	89.8	88.9	81.3	S. W.	Cumuli.	.590	92.3	91.6	82.9	S. W.	Ditto											
6																													
7	.590	81.3	82.5	80.3	S. S. W.	Cirro cumuli.	.624	89.0	88.2	81.5	S. W.	Cumulo strati.	.604	92.0	91.3	83.3	S. W.	Cumulo strati.											
8	.563	82.8	83.4	80.3	S. W.	Cloudy.	.614	84.3	84.6	79.2	S. W.	Cloudy.	.582	88.4	87.9	80.6	S. W.	Ditto											
9	.619	81.5	82.3	80.4	W. S. W.	Ditto	.698	76.3	77.0	75.9	N. N. W.	Rainy.	.675	76.9	77.0	76.3	S.	Rainy.											
10	.715	76.6	77.7	76.9	S.	Rainy.	.724	83.5	82.6	79.8	S. S. E.	Cloudy.	.703	87.7	87.0	83.2	S. S. W.	Cirro cumuli.											
11	.678	81.0	81.8	80.3	S. S. W.	Cloudy.	.724	89.0	88.4	82.8	S. S. E.	Cumuli.	.698	91.6	90.5	83.5	S. S. W.	Cumuli.											
12	.662	81.3	82.2	80.2	S. W.	Cirro cumuli.	.680	88.9	88.0	81.8	S. W.	Cumulo strati.	.652	91.8	91.0	82.4	S.	Cumulo strati.											
13	.625	81.6	82.2	80.5	S.	Cumuli.	.652	89.3	89.0	81.7	S. S. W.	Cumuli.	.639	90.9	89.8	81.5	S. W.	Ditto.											
14	.650	81.2	82.3	80.3	S.	Cloudy.	.674	89.2	88.5	80.7	S. S. W.	Cirro cumuli.	.679	90.3	90.0	87.0	S.	Cumuli.											
15	.629	82.3	83.0	80.9	S.	Cirro cumuli.	.626	89.3	88.7	82.7	S.	Cloudy.	.654	92.0	91.6	82.9	S. S. W.	Cumulo strati.											
16	.581	82.0	82.9	80.2	S.	Cloudy.	.639	89.9	89.4	82.2	S. W.	Cirro cumuli.	.642	90.5	90.0	82.9	S. W.	Cloudy.											
17																													
18																													
19																													
20																													
21																													
22																													
23																													
24	.624	80.2	80.8	79.4	S.	Cirro strati.	.736	91.0	88.8	82.0	S. S. E.	Cumulo strati.	.716	93.8	91.7	83.0	S. S. E.	Cumulo strati.											
25	.576	80.3	80.8	79.2	S. E.	Ditto	.630	90.6	89.0	81.7	S. E.	Ditto	.636	93.3	91.0	82.9	S. E.	Ditto.											
26	.642	80.0	80.8	79.0	E.	scatd. clouds.	.639	89.5	86.5	80.3	E.	Ditto	.646	93.0	90.8	80.8	E. S. E.	Nimbi.											
27	.592	79.8	80.2	78.3	E.	Cirro strati.	.595	88.7	87.4	81.3	E.	Ditto	.563	86.3	85.4	81.4	E.	Cumulo strati.											
28																													
29	.471	79.8	80.3	78.8	E.	Cloudy.	.522	90.1	87.2	81.9	E. S. E.	Ditto.	.499	92.0	89.3	82.0	S. E.	Cumulo strati.											
30	.473	79.8	80.0	78.8	E.	Ditto	.493	87.0	83.8	80.7	S. E.	Nimbi.	.471	90.7	89.8	82.0	S. S. E.	Ditto											
31	.441	81.2	81.9	79.8	S.	Ditto	.513	89.0	86.3	81.7	E. N. E.	Cumulo strati.	.482	87.5	86.3	82.0	N. E.	Ditto											
Mean	30.524	80.4	81.1	79.3	....	....	29.624	87.9	86.6	81.1	....	....	29.604	93.0	86.7	82.2	....	....											

Mean

Observations made at 2h. 40m.

Minimum Pressure observed at 4 p. m.

Observations made at sun set.

Maximum and Minimum Thermometer.

Rain Gauge, Feet, Feet, Moon's phases Date.

Bar. red. to 32° F.	Temperature.			Wind.	Aspect of Sky.	Bar. red. to 32° F.	Temperature.			Wind.	Aspect of Sky.	Bar. red. to 32° F.	Temperature.			Wind.	Aspect of Sky.	Maximum and Minimum Thermometer.			Upper.	Lower.	Moon's phase and Date.
	Of Mer.	Of Air.	W. Bulb.				Of Mer.	Of Air.	W. Bulb.				Of Mer.	Of Air.	W. Bulb.			Max.	Mean.	Min.			
39.409 91.2 90.0	°	°	°	S. W.	Cumulo strati.	29.387 90.2 88.8 80.8	°	°	°	W N W	Nimb.	29.427 86.4 81.8 80.0	°	°	°	W N W	Rainy.	91.8 84.6 77.4	110.2	110.2	Inch.	Inch.	1
497 88.3 87.3	S. W.	°	°	Ditto	.487 88.0 86.9 80.6	°	°	°	S. W.	Cumulo strati.	Nimb.	.517 88.7 82.3 78.4	°	°	°	S.	Clear.	88.8 83.9 79.0	105.7	105.7	2.48	2.48	2
556 91.0 90.4	S.	°	°	Ditto	.527 92.8 91.2 81.8	°	°	°	S.	Nimb.	Nimb.	.550 84.3 85.0 81.8	°	°	°	S. S. W	Cirro strati.	93.2 86.6 79.9	110.3	110.3	0.30	0.36	2
543 89.4 85.7	S. S. E.	°	°	Drizzly.	.532 86.4 85.3 82.5	°	°	°	S. S. E.	Cloudy.	Cloudy.	.546 84.5 84.7 80.3	°	°	°	S.	Ditto	93.0 87.0 81.0	111.5	111.5	0.30	0.36	4
538 92.8 92.0	S. S. E.	°	°	Cumulo strati.	.503 92.9 91.9 80.4	°	°	°	S.	Cumulo strati.	Cumulo strati.	.529 87.3 87.3 80.7	°	°	°	S.	Cirro cumuli.	94.2 87.8 81.3	109.0	109.0	0.14	0.22	5
538 92.2 91.4	S.	°	°	Cumulo strati.	.526 92.4 91.8 84.3	°	°	°	S.	Cumulo strati.	Cloudy.	.538 86.6 86.7 81.8	°	°	°	S.	Scattered clouds	93.3 87.4 81.5	105.4	105.4	0.92	1.00	6
532 89.4 88.3	S. W.	°	°	Drizzly.	.572 80.0 79.7 77.7	°	°	°	N. W.	Rainy.	Cloudy.	.576 78.7 79.0 77.3	°	°	°	S.	Drizzly.	90.2 86.9 83.5	98.0	98.0	2.26	2.30	7
665 77.0 77.4	S. W.	°	°	Cumulo strati.	.646 89.5 88.8 83.0	°	°	°	S. S. W	Cumulo strati.	Cloudy.	.668 79.0 79.0 77.3	°	°	°	S. W.	Cloudy.	92.8 79.7 76.6	105.7	105.7	2.26	2.30	8
679 91.2 90.2	S. W.	°	°	Cumulo strati.	.621 87.7 87.0 82.2	°	°	°	S. S. W	Cloudy.	Cloudy.	.603 85.3 85.6 80.9	°	°	°	S. S. W	Cloudy to Nor.	91.7 83.9 76.0	105.7	105.7	2.26	2.30	9
644 90.7 90.0	S. W.	°	°	Ditto.	.567 91.4 90.5 82.8	°	°	°	S. S. W	Cumulo strati.	Cumulo strati.	.569 86.2 86.3 81.3	°	°	°	S. S. W	Cirri.	93.6 87.8 82.0	106.8	106.8	0.92	1.00	10
593 92.2 91.4	S. S. W.	°	°	Ditto.	.558 91.3 90.7 81.0	°	°	°	S.	Cirro strati.	Cumulo strati.	.575 86.8 86.6 80.6	°	°	°	S. S. W	Scattered clouds	93.0 87.6 82.2	105.0	105.0	0.92	1.00	11
563 92.3 91.4	S. W.	°	°	Ditto.	.618 88.8 89.4 82.8	°	°	°	S.	Cumulo strati.	Cumulo strati.	.613 87.4 87.7 81.7	°	°	°	S.	Cumulo strati.	92.8 87.4 82.0	101.0	101.0	0.92	1.00	12
598 92.8 92.4	S. W.	°	°	Ditto.	.579 92.0 91.3 83.5	°	°	°	S.	Ditto	Cumulo strati.	.580 87.5 87.5 82.0	°	°	°	S. W.	Clear.	93.8 88.5 83.0	106.0	106.0	0.92	1.00	13
563 92.0 92.2	S. S. W.	°	°	Ditto.	.537 93.0 92.5 83.4	°	°	°	S. W.	Ditto	Cumulo strati.	.547 88.0 88.0 83.5	°	°	°	S.	Cloudy.	93.4 88.1 82.7	103.2	103.2	0.92	1.00	14
564 92.3 91.2	S.	°	°	Cirro cumuli.	.563 92.2 91.3 82.7	°	°	°	S.	Cirro cumuli.	Cumulo strati.	.603 84.6 84.5 79.0	°	°	°	S.	Cloudy.	94.0 87.0 80.0	105.0	105.0	0.92	1.00	15
618 84.0 84.0	S.	°	°	Cloudy.	.603 84.6 84.5 79.0	°	°	°	S.	Cloudy.	Cloudy.	.560 92.0 91.0 81.7	°	°	°	S.	Cloudy.	94.5 88.0 81.5	107.0	107.0	0.92	1.00	16
558 93.5 92.2	S. W.	°	°	Ditto.	.535 91.6 91.2 82.8	°	°	°	S.	Cumuli.	Cumuli.	.539 92.0 91.0 81.7	°	°	°	S.	Cloudy.	95.5 89.3 83.0	111.0	111.0	1.74	1.74	17
576 93.0 91.5	S. W.	°	°	Ditto.	.571 90.0 88.9 82.2	°	°	°	S.	Cloudy.	Cloudy.	..	°	°	°	S.	Cloudy.	91.0 87.7 83.0	102.5	102.5	0.92	1.00	18
566 90.7 90.0	S.	°	°	Cumulo strati.	.627 86.0 87.7 82.0	°	°	°	S. E.	Cumulo strati.	Cumulo strati.	.549 86.0 85.9 81.2	°	°	°	S.	Cirro strati.	95.0 87.4 79.8	112.3	112.3	0.12	0.18	19
538 92.2 91.4	S. S. E.	°	°	Cloudy.	.545 90.4 88.0 81.4	°	°	°	S. E.	Cloudy.	Cumulo strati.	.549 86.7 86.5 80.7	°	°	°	S.	Cirro cumuli.	92.3 86.7 81.0	111.2	111.2	0.42	0.42	20
566 86.3 85.3	N. E.	°	°	Nimb.	.543 82.9 80.7 77.7	°	°	°	W.	Ditto	Cumulo strati.	.575 83.0 83.4 80.4	°	°	°	N. E.	Cumulo strati.	90.7 85.9 81.0	110.5	110.5	0.38	0.40	21
594 89.3 88.1	N. E.	°	°	Ditto.	.557 88.8 86.0 81.5	°	°	°	S. S. E.	Nimb.	Nimb.	.576 84.2 84.1 81.4	°	°	°	S. E.	Ditto	90.6 85.7 80.8	107.2	107.2	0.38	0.40	22
499 88.1 87.0	N. E.	°	°	Cumulo strati.	.479 88.8 83.8 81.2	°	°	°	S.	Rainy.	Rainy.	.499 83.5 84.0 79.2	°	°	°	S. S. E.	Scattered clouds	90.0 85.0 80.0	106.0	106.0	0.74	0.78	23
455 84.8 82.5	E.	°	°	Cloudy.	.451 84.8 83.2 80.4	°	°	°	S. E.	Cumulo strati.	Cumulo strati.	.459 83.5 84.0 80.0	°	°	°	S. E.	Cumulo strati.	91.6 85.9 80.2	109.6	109.6	0.28	0.32	24
439 89.4 86.7	S. S. E.	°	°	Rainy.	.418 87.9 86.9 81.0	°	°	°	S. S. E.	Rainy.	Rainy.	.430 83.2 83.0 80.2	°	°	°	S. E.	Nimb.	91.8 85.9 80.0	109.2	109.2	0.44	0.48	25
408 93.4 92.3	N. E.	°	°	Cumulo strati.	.385 91.0 88.4 82.9	°	°	°	S. E.	Cloudy.	Cloudy.	.427 83.6 83.6 81.2	°	°	°	S. S. E.	Rain & Thun.	93.8 87.0 80.2	112.0	112.0	0.82	0.88	26
39.409 91.2 90.0	°	°	°	S. W.	29.387 90.2 88.8 80.8	°	°	°	W N W	Nimb.	Nimb.	29.427 86.4 81.8 80.0	°	°	°	W N W	Rainy.	91.8 84.6 77.4	110.2	110.2	Inch.	Inch.	27



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*On the Physical Geography of the Himálaya. By B. H. HODGSON, Esq.*

A clear outline, illustrated by a sketch map, of the principal natural divisions of the Himálaya, is, and long has been, a great desideratum; for, physical Geography, which derives so many aids from the other physical sciences, is expected in return to render back to them without unnecessary delay a distinct demarcation of its own provinces, since by that alone researchers in so many departments are enabled to refer the respective phenomena they are versant with to their appropriate local habitations, in a manner that shall be readily intelligible, causally significant, and wholly independant of the shifting and unmeaning arrondissements of politics.

It is true that our knowledge of the large portion of these mountains lying beyond the limits of British dominion, is far from complete. But is our knowledge any thing like complete of our own hill possessions? and, if we are to wait until Népál, Sikim and Bhútán become thoroughly carrossable to science, must we not indefinitely postpone a work, the most material part of which may (I think) be performed with such information as we now possess?

The details of Geography, ordinarily so called, are wearisomely insignificant; but the grand features of physical geography have a pregnant value, as being alike suggestive of new knowledge, and facilitative of the orderly distribution and ready retention of old. I purpose to adhere to those grand features, and to exhibit them in that causal connexion which gives them their high interest with men of mind.

I had been for several years a traveller in the Himálaya before I could get rid of that tyranny of the senses which so strongly impresses almost all beholders of this stupendous scenery with the conviction that the mighty maze is quite without a plan. My first step towards freedom from this overpowering obtrusiveness of impressions of sense was obtained by steady attention to the fact that the vast volume of the Himálayan waters, flows more or less at right angles to the general direction of the Himálaya, but so that the numberless streams of the mountains are directed into a few grand rivers of the plains, either at or near the confines of the two regions. My next step was due to the singular significance of the topographic nomenclature of the Nepalese, whose "Sapt Gandaki" and "Sapt Cousika,"\* rivetted my attention upon the peculiar aqueous system of the Himálayas, urging me thence forward to discover, if possible, what cause operated this marked convergence of innumerable transverse parallel streams, so as to bring them into a limited series of distinct main rivers. My third and last step was achieved when I discovered that the transcendant elevation and forward position, at right angles to the line of gháts, of the great snowy peaks, presented that causal agency I was in search of, the remotest radiating points of the feeders of each great river being coincident with the successive loftiest masses† belonging to the entire extent of the Himálaya. It was in Népál that this solution of these problems occurred to me, and so uniformly did the numerous routes I possessed represent the points of extreme divergence of the great rivers by their feeders as syntopical with the highest peaks, that I should probably long ago have satisfied myself upon the subject, if my then correspondent, Capt. Herbert, had not so decidedly insisted on the very opposite doctrine—to wit, that the great peaks intersect instead of bounding the principal alpine river basins.

Capt. Herbert's extensive personal conversancy with the western Himálaya, added to his high professional attainments, made me for a long time diffident of my own views. But, the progress of events and increasing knowledge of other parts of the chain, seeming to confirm

\* See Journal, No. 198 for Dec. 1848, p. 646, &c.

† This expression is used advisedly, for every pre-eminent elevation of the Himálaya is not so much a peak as a cluster of peaks springing from a huge sustaining and connected base.

the accuracy of those views, it occurred to me more carefully to investigate whether the facts and the reason of the case were not, upon the whole, demonstrative of the inaccuracy of that able and lamented officer's dogma. Doubtless the western Himálaya presents appearances calculated to sustain Capt. Herbert's opinion, whilst such persons only as are unaccustomed to deal with the classifications of science will expect them to correspond point by point with those natural phenomena, which it is at least one chief merit of such arrangements, merely to enable us readily to grasp and retain. But, that the entire body of facts now within our ken is upon the whole opposed to Capt. H.'s doctrine,\* and that that doctrine suits ill with the recognised axioms of geology and geography, is, I think, certain, and I shall with diffidence now proceed to attempt the proof of it.

A tyro in geology, I shall not further dwell on the theoretical side of the question than may be requisite to facilitate and complete the apprehension of my readers: but the facts, quoad Nepal at least, I trust that my sketch map, rude as it is, and the following observations, may render sufficiently indisputable; it being always remembered that I deal with generals, not particulars, aiming to establish the general accuracy of my main proposition, viz., that the great peaks, bound instead of intersecting the alpine river basins, and that, in truth, the peaks by so bounding *create* the basins, whereas their *intersection would destroy them*.

And now, without further preface, I turn to the accompanying sketch map, and submit such remarks as it seems to require. It will be seen at a glance that it embraces the whole Himálaya from  $78^{\circ}$  to  $94^{\circ}$  of longitude, comprising the following peaks and basins;—peak of Jamnouri (a), peak of Nanda-dévi (A), peak of Dhoula-giri (B), peak of Gosainthán (C), peak of Kanchang (D), peak of Chumalari (E), peak of the Gemini† (e): which peaks include and constitute the following alpine river basins, viz., that of the Ganges, that of the Karnáli, that of the Gandak, that of the Cói, that of the Tishta, that of the Mónas, and that of the Subhansri (pars). The subjoined table exhibits the elevation and the position of these dominant peaks with the authority for both.

\* Journal, No. 126, Extra, pp. 20 and 22.

† I have so named the two proximate peaks of nearly equal height, which are inserted without name in Pemberton's large map, in long.  $92^{\circ} 50'$ , lat.  $27^{\circ} 50'$ .

- a Jamnoutri 25669 30°55' 78°12' J. A. S. No. 126, As. Res. Vol. XII.  
 A Nanda-dévi 25598 30°22' 79°50' J. A. S. No. 126.  
 B Dhoula-giri 27600 29°10' 83° As. Res. Vol. XII. J. A. S. No. 126.  
 C Gosain-than 24700 28°20' 86° As. Res. Vol. XII.  
 D Kangchang 28176 27°42' 88°10' J. A. S. No. 197, with map annexed.  
 E Chumalari 23929 27°52' 89°18' The same.  
 e Gemini  $\left\{ \begin{smallmatrix} 21600 \\ 21476 \end{smallmatrix} \right\}$  27°50' 92°50' Pemberton's Report and map.

The longitudinal dark lines of the map indicate, the upper one, the Himálaya proper, the lower one, the last low range verging on the plains. The transverse or vertical dark lines denote the great peaks with the ridges sent southwards by them. The Himálaya proper is traced along the line of the gháts or water shed between Tibet and India; and the principal passes of Népál and Sikim into Tibet, or Taklakhár, Mústáng, Kérúng, Kúti, Hatia, Wallúng, Láchén, are set down along the Himálaya, as well for their novelty as to illustrate the ghát line of the snows.

Along the last low range of hills are marked the position of the Máris or Dhúns, within the range, and the position of the Bháver and Tarai, without it.

Sallyán mári, Gongtali mári, Chitwan mári, Makwáni mári and Bijay-púr mári, are so many Nepalese samples of those singular quasi valleys, termed Dhúns to the westward.\* In the plateau of Tibet I have indicated the limits of the three great trans-Himálayan provinces, or Gnári, extending (from the Bélúr) easterly to the Gangri boundary range of lake Mépang; Utsáng, thence stretching to the Gakbo river beyond Lassa; and Khám, which reaches from the Gakbo river to the Yúnling or Péling or limitary range of China and Tibet. Thus, reverting to the regions south of the line of gháts leading into Tibet, we have, clearly defined, the several natural provinces or divisions of the Himálaya, with their causal distribution, as follows, commencing from the westward, 1st, the alpine basin of the Ganges, extended from the peak of Jamnoutri to the peak of Nanda-dévi (Juwár or Juwáhir,) or, in other words, from east long. 78° 12' to 79° 50'; 2nd, the alpine basin of the Karnáli, reaching from the peak of Nanda-dévi to that of Dhoula-giri, or from 79° 50' to 83°; 3rd, the alpine basin of the Gandak, stretching from the peak of Dhoula-giri to that of Gosain-than, or

\* See J. A. S. No. 126, p. xxxiii. et seq. and p. cxxxiv.

from  $83^{\circ}$  to  $86^{\circ}$ : 4th, the alpine basin of the Cói extending from the peak of Gosain-thán to that of Kangchang, or from  $86^{\circ}$  to  $88^{\circ} 10'$ : 5th, the alpine basin of the Tishta, reaching from the peak of Kangchang to that of Chumalári, or from  $88^{\circ} 10'$  to  $89^{\circ} 18'$ : 6th, the alpine basin of the Mónás, stretching from the peak of Chumalári to that of the Gemini, or from  $89^{\circ} 18'$  to  $92^{\circ} 50'$ : and, lastly, the alpine basin of the Subhansri, of which the western limit is the Gemini, but the eastern peak, unascertained. It should be sought somewhat about  $94^{\circ} 50'$  between which point and the extreme eastern limits of the Himálaya, must be the basin of the Dihóng. That the above distribution of the Himálaya into natural districts is, upon the whole, as consistent with the facts as it is eminently commodious and highly suggestive, I have no hesitation of asserting. Lest however I should extend my present<sup>t</sup> Essay to undue limits to trench upon the province of Col. Waugh and the other able professional men who are now engaged upon the western hills, I shall say nothing further of the alpine valley of the Ganges and those west of it, nor upon those lying east of Sikim. If my main assumption be valid, it will be easily worked out by abler hands and better furnished ones than mine: wherefore the following more detailed expositions will be chiefly confined to the three great central basins of the Karnáli, the Gandak, and the Cói. In the first of these basins we have (successively from west to east) the Sarjú, the Góri, the Káli, the Swéti-ganga, the Karnáli proper, the Bhéri and the Jhingrak or Rapti. And it is certain that, whereas these streams drain the whole alpine valley of the Karnáli, so their most westerly source and course is confined on the west by the Nanda-devi peak, as their most easterly is limited on the east by that of Dhoula-giri. These rivers do not wholly unite within the hills, though their tendency to union is so decided that they are known by one name, even in the plains, where their collective appellation is Sarjú, vel Káli, vel Ghógra. In the hills the whole of them are universally denominated by the collective name of Karnáli (corrupted by Rennell and his followers into Kenár). Karnáli is the proper name of this noble river, the Karnáli branch being by far the largest the central and most remote of origin. It rises in Tibet, not far from one of the sources of the Satlege, and has a considerable trans-Himálayan course to the westward of the Taklakhár pass, where it quits Tibet. No natural district can be more distinct than the alpine basin of

the Karnáli, as above defined. It includes the political divisions of Káli Kúmáun, belonging to Britain, and of the Báisi, or 22 Rájes of Nepál, with Yúmila vel Júmla, Dóti and Sallyán. In the second basin, or that of the Gandak, we have, successively from the west, as before, the Barigár, the Náráyani, the Swéti-gandaki, the Marsyángdi, the Daram-di, the Gandi, and the Trisúl. These are the "Sapt Gandaki" or seven Gandaks of the Nepalese, and they unite on the plainward verge of the mountains at Tirbéní above Sáran. They drain the whole hills between Dhoulá-giri and Gosain-thán; the Barigár and one head of the Náráyani, rising from the former barrier, and the Trisúl, with every drop of water supplied by its affluents, from the latter. Nor does a single streamlet of the Tirsúl arise east of the peak of Gosain-thán, nor one driblet of the Barigár deduce itself from the westward of Dhoulá-giri. We have thus in the alpine basin of the Gandak another admirably defined natural division comprised within two great proximate Himálayan peaks. This division is named, vernacularly, the Sapt Gandaki. It includes the old Choubáisi, or 24 Rájes and belongs to the modern kingdom of Népál.

Our third sample of a Himálayan natural province conterminous with the utmost spread of the feeders of a large river, and bounded on either hand by a prime snowy peak, is the basin of the Cósi, which, like the Gandak, has seven principal feeders. These are as follows: the Milamchi, the Bhotia Cósi, the Támba Cósi, the Likhú, the Dúd Cósi, the Arún, and the Tamór. Of these, the Milamchi, rising from Gosain-thán, is the most westerly, and the Tamór, rising from Kang-chang, is the most easterly, feeder.\* And those two great peaks, with the pre-eminent ridges they send forth southwards, include every drop of water that reaches the great Cósi of the plains through its seven alpine branches. All these branches, as in the case of the Gandak, unite (at Varáha Kshétrá above Náthpúr) within the hills, so that the unity of this alpine basin also is as clear as are its limitary peaks and its extent.

The alpine basin of the Cósi is denominated by the Nepalese the Sapt Cousika, or country of the seven Cósís. It comprises the old Rájes of the Kirántis,† Limbús and Kála Makwánis, and is included, like the two prior basins, in the modern kingdom of Népál.

\* See J. A. S. No. 189. Route from Kathmandu to Darjeeling.

† The classical Cirrhatae, and a once dominant and powerful race, though they



The country drained by the above three rivers (Karnáli, Gandak and Cósi) includes the whole of Népál and the proximate part of Kúmáun, or, in other words, 800 miles of the central and most characteristic portion of the Himálaya. Wherefore it is legitimately presumeable that whatever is true of its natural divisions, is true of those of the residue, quoad ruling principle and geological causation.

Now, if the above facts relative to these three rivers be justly represented (and that they are so, in the main, I confidently assert), we are led irresistibly to inquire *why* the numerous large feeders of the rivers, instead of urging their impetuous way from the snows to the plains by independant courses, are brought together upon or near the verge of the plains? *how* unity is effected among them despite the interminable maze of ridges they traverse, and despite the straight downward impulse given them at their sources?—I answer, it is because of the superior elevation of the lateral barriers of these river basins, between which there are synclinal slopes of such decided preponderance that they overrule the effect of all other inequalities of surface, how vast soever the latter may sometimes be.

It will be seen by the map that these lateral barriers of the river basins are crowned by the pre-eminent Himálayan peaks, that the peaks themselves have a forward position in respect to the ghát line or great longitudinal water shed between Tibet and India, and that from these stupendous peaks, ridges are sent forth southwards proportionably immense. Thus from the peak of Kangchang is sent forth the ridge of Singiléla, which towers as loftily over all the other sub-Himálayan ridges of eastern Népál and western Sikim as does Kangchang itself over all the other Himálayan peaks.

This Singilélan prolongation (so to speak) of Kangchang, entirely separates the waters of the Cósi and of the Tishta. A similar ridge, that of Dayabhang,\* stretching south from the great peak of Gosainthán, as entirely divorces the waters of the Cósi and of the Gandak. Another like ridge rising from Dhoula-giri as effectually sunders the waters of the Gandak and of the Karnáli. Another starting from

have long since succumbed to the political supremacy of other races—first the Makwánis and then the Gorkhális.

\* Hence the name Dhaibúng, erroneously applied by Col. Crawford to the peak. Dayabhang, the destroyer of pity, from the severity of the ascent.

Nunda-dévi in like manner wholly separates the proximate feeders of the Karnáli and of the Ganges; whilst yet another originating with Jamnoutri, wholly separates the Ganges from the Jumna.

Equally effective with the divergent power of each of these supremely peaked ridges, which run parallel to each other and at right angles to the ghát line of the snowy range, upon two river basins, as just noticed, is of course the convergent power of two ridges upon the single contained river basin. The synclinal lines from the inner faces of the two adjacent ridges draw the waters together; and, because these ridged peaks are the *loftiest masses of the entire mountains*, the effect of all their other masses, even that of the spine of Hemáchal or the ghát line of the snows, is overruled or modified, so that in the ruggedest region on earth a very limited series of distinct main rivers appears in the plains from innumerable independent alpine feeders, in the manner which all behold but few indeed think of referring to its cause.

It is inconsistent with all we know of the action of those hypogene forces which raise mountains, to suppose that the points of greatest intensity in the pristine action of such forces, as marked by the loftiest peaks, should not be surrounded by a proportionate circumjacent intumescence of the general mass; and, if there *be* such an intumescence of the general surface around each pre-eminent Himálayan peak, it will follow, as clearly in logical sequence as in plain fact it is apparent, that these grand peak crowned ridges will determine the essential character of the aqueous distribution of the very extended mountainous chain (1800 miles) along which they occur at certain palpable and tolerably regular intervals. Now, that the infinite volume of the Himálayan waters is, in fact, pretty regularly distributed into a small number of large rivers, we all see; and, whereas the fact is thoroughly explicable upon my assumption that the great peaks bound, instead of intersecting, the river basins, it is wholly inexplicable upon Capt. Herbert's assumption that the said peaks intersect the basins.

The above are normal samples of Himálayan water distribution, and it is very observable that whereas all those principal streams which exhibit the unitizing principle so decidedly, take their origin in the alpine region, at or near the snows, so the inferior streams which rise from the middle region only, show no such tendency to union, but pursue their solitary routes to the Ganges; as for example, the Mahanada, the Méchi, the

Konki the Bágmatti, the Gumti, the Cosilla and the Rámanga. Here is both positive and negative evidence in favour of the doctrine, I advocate as furnishing the key to the aqueous system and natural divisions of the Himálaya ; for, the upper rivers do, and the lower rivers do not, stand exposed to the influence of the great peaks.

The petty streams of the lower region or that next the plains, which water the Dhúns vel Maris, traverse those valleys lengthwise ; and, as the valleys themselves run usually parallel to the ghát line of the snows, such is also the direction of these petty streams. In the central, as in the western,\* hills they usually disembogue into the rivers of the first class.

I have observed that the three great river basins of the Karnáli, Gandak and Cósi extend throughout Nepál ; and truly so ; for a river basin, includes the widest space drained by its feeders. But, it results necessarily from the manner in which the deltic basins of the Himálayan rivers are formed, that there should be intervals between the plainward apices of these deltic basins. Of these intervals the most conspicuous in Népal, is that which intervenes between the Cósi and Gandak. This tract, watered by the Bágmatti, deserves separate mention on many accounts, and it may be conveniently styled the valley region, since it contains not only the great valley of Népal proper, but also the subordinate vales of Chitlong, Banépá and Panouti.

It has been already remarked that the classifications of physical geography, as of the other sciences, do not constitute a perfect "open sesame" to the mysteries of nature, but only a material help to their study. This observation I will illustrate by a few comments on the basin of the Tishta, lest the somewhat anomalous instance of that basin, should be captiously quoted to impugn the doctrine I contend for ; but contend for, not as exhibiting in every instance an absolute conformity with natural arrangements, but as doing all that can be reasonably expected in that way, and as furnishing, upon the whole, a generally truthful, causally significant, and practically useful, indication of those arrangements.

I have stated above that the basin of the Tishta extends from the peak of Kanchang to that of Chúmálári. But an inspection of the accompanying map will show that between these two peaks there occurs

\* J. A. S. No. 126, p. xxxiii.

what miners call "a fault" in the ghát line of the snows, which line, after proceeding N. Easterly from the Láchén to Powhanry,\* dips suddenly to the south for nearly 40 miles, and then returns to Chúmálári. A triangular space called Chúmbi is thus detached from the Himálaya and attached to Tibet; and the basin of the Thista is thus narrowed on the east by this salient angle of the snows, which cuts off the Chúmbi district from the Tishtan basin, instead of allowing that basin to stretch easterly to the base of Chúmálári. Chúmbi is drained by the Máchú of Campbell, which is doubtfully referred to the Torsha of the plains, but which may possibly be identical with the Háchú of Turner and Griffiths,† or the Gaddada of the plains. But besides that these points are still unsettled, it will be noted that one of the transnivean feeders of the Tishta rounds Powhanry and rises from a lake (Cholámú) approximating to Chúmálári; so, that, one way or another, the Tishta may be said, without much violence, to spread its basin from Kang-chang to Chúmálári.

Chúmbi and all the adjacent parts of the plateau of Tibet, constitute a region as singular as is the access to it from Sikim by the Láchén pass. That pass surmounted, you at once find yourself, without descent, upon an open undulated swardy tract, through which the eastern transnivean feeders of the Tishta and of the Arún sluggishly and tortuously creep, as though loath to pass the Himálaya, towards which

\* Vide Waugh's outline of the snowy range of Sikim, J. A. S. loc. cit.

† Embassy to Tibet and J. A. S. Nos. 87 and 88, with sketch maps annexed. Also Pemberton's large map of the eastern frontier. Rennell is not easily reconcilable with them. In the accompanying map I had identified the lakes of Cholámú, which give rise to the Tishta, with Turner's lakes. But I now learn from Hooker that the latter lie a good deal east of the former, and I am satisfied that Campbell's Máchú is distinct from Turner's Hachu. We need, and shall thus find, space in the hills correspondent to that in the plains watered by Rennell's Torsha and Saradngoh and Gaddada and Suncósi. The Máchú, (Maha tchieu apud Turner) rises from the West flank of Chúmálári. The Háchú of Turner is a feeder joining his Máchú from the West. The Chaan chú of Turner is the Suncósi of Rangpúr: his Tehin chú is the Gaddada, and his Máhá chú, the Torsha. The Arún has its rise in the broken country of Tibet lying N. and a little W. of the sources of the Tishta and South of the Kambalá, or great range forming the Southern boundary of the valley of the Yáru. This broken country Dr. Hooker estimates at from 16 to 18000 feet above the sea. It is a good deal terraced near Himachal.

indeed it is not easy to perceive how they are impelled, the plateau of Tibet sloping on their right to Digarchi, and seeming to invite the streams that way. There is however of course a water-shed, though by no means a palpable one; and we know by the signal instances of the vast rivers of South America and those of north-eastern Europe, how inconspicuous sometimes are the most important water-sheds of the globe. The sources and courses of the feeders of the Tishta will shortly be fully illustrated by Dr. Hooker, my enterprising and accomplished guest, to whom I am indebted for the above information relative to the Láchén pass and its vicinity, and whose promised map of Sikim, which state is the political equivalent for the basin of the Tishta, will leave nothing to be desired further on that head.

But the Himálaya must necessarily be contemplated in its breadth as well as its length; and we have therefore still to consider what regional divisions belong to these mountains in relation to their breadth, or the distance between the ghát line of the snows and the plains of India.

The Himálayan mountains extend from the great bend of the Indus, to the great bend of the Brahmapútra, or from Gilgit to Brahma Kúnd, between which their length is 1800 miles. Their mean breadth is about 90 miles; the maximum, about 110, and the minimum, 70 miles. The mean breadth of 90 miles may be most conveniently divided into three equal portions, each of which will therefore have 30 miles of extent. These transverse climatic divisions must be, of course, more or less arbitrary, and a microscopic vision would be disposed to increase them considerably beyond three, with reference to geological, to botanical, or to zoological, phenomena. But, upon comparing Capt. Herbert's distribution of geological phenomena with my own of zoological, and Dr. Hooker's of botanical, I am satisfied that three are enough. These regions I have already\* denominated the lower, the middle and the upper. They extend from the external margin of the Tarai to the ghát line of the snows. The lower region may be conveniently divided into—I. the sand-stone range with its contained Dhúns or Máris;—II. the Bháver or Saul forest;—III. the Tarai. The other two regions require no subdivisions. The following appear to be those demarcations by height which most fitly indicate the three regions.

\* J. A. S. for December 1847, and June 1848.

*Name.**Elevational limits.*

Lower region . . . . . Level of the plains to 4000 feet above the sea.

Central region . . . . . 4000 to 10,000 feet above the sea.

Upper region . . . . . 10,000 to 16,000\* feet above the sea : Highest peak measured is 28,176.

It is needless to remind those who are conversant with physical geography, that in passing in a tropical country, by a long and gradual ascent, from near the sea level to several (4-6) miles above it, one must necessarily meet with regions equivalent, quoad organic phenomena to the three great zones of the earth, or the tropical, the temperate and the arctic; and, in fact, our three regions above indicated correspond in the main with those zones, and might be named after them, but that it is desirable to avoid terms involving theory, when those designating mere facts will suffice. Nor is it merely by organic phenomena that the three regions are contradistinguished.

In geology the upper region is the locale of granites and gneisses; the middle region, that of gneisses and schists; the lower region that of the sandstone formation and of diluvial debris. It may be added that granite is much more extensively developed, in the upper region than had been supposed, and that igneous rocks are by no means so entirely unknown. Indeed igneous *action* is displayed to a stupendous degree, in the hypogene rocks both stratified and unstratified of the upper and even central region. In botany the first is the region of Junipers, Cedars, Larches, dwarf Rhododendrons, Hollies, Willows, Walnuts, Birches, and in general of the superior sorts of Coniferæ; the second, that of Oaks, Chesnuts, Magnolias, Laurels, Alders, tree Rhododendrons (many kinds). Cherry and Pear trees (large and wild), Oleas (large forest tree), Maples, Wax trees, Camelias, tree ferns, some few and peculiar Palms (*Chamerops*, &c.), and the inferior sorts of Pines; the last, that of *Sauls* (*Shorea*), *Sissus* (*Dalbergia*), *Acacias*, *Tunds* (*Cedrela*), cotton trees (*Bombax*) tree figs, (*Catechu*, *Indicus et Religiosus*.) *Buteas*, *Dillénias*, *Baudangas*, *Erythrinas*, *Premnas*, some common Palms (*Phoenix*, &c.) but rare and poor, and, lastly, tree ferns, but much rarer than above. *Pinus longifolia* likewise recurs in this region, but not one other of the many

\* This is about the average height of the gháts and of the perpetual snow. It is also nearly the limit of possible investigation, and of the existence of organic phenomena. But the upward limit need not be rigorously assigned.

Conifers above.\* In Zoology, again, to begin with man, the upper region is the exclusive habit of the Bhótias, who extend along the whole line of the gháts, and who, with the name, have retained the lingual and physical characteristics of their tramontane brethren. To the central region are confined, but each in their own province from east to west, the Mishmis, the Bors and Abors, the Ákás, the Daphlas, the Lhópás, the Lepchas, the Limbús, the Kirántis, the Múrmis, the Néwárs, the Súnwárs, the Chépáangs, the Gúrúngs, the Magars, the Khas or Khasias, the Kóhlis, the Garhwális, the Kakkas, the Bambas, the Gakars, the Khatirs, the Awáns, and the Janjúhs. To the lower region are as exclusively limited the Kócch, the Bódó, the Dhímál, the Kichak, the Thárú, the Dénwár, the Pallah, and the Bóksar. Of these races, those of the central region are all of transnivean origin like the first named; but they are much altered in speech and aspect, by 12 to 15 centuries of residence in a cisnivean climate, and by mixture in some few cases (as Khas or Khasia) with southern blood; whilst the races of the lower region are of the aboriginal Indian or Tamulian stock, and nearly unmixed, though some of them have adopted the speech and customs of the Hindus.† The hill Bráhmans, Rájpúts and Moslems so common to the westward, so rare to the eastward, are mere modern immigrants from the plains. It is very deserving of special notice that the people of the upper region cannot endure the climate of the central one, nor those of the central region, the climate of the lower one; so that the distribution even of the human race in the Himálaya affords a remarkable verification of our triple transverse division from a quarter the least likely to afford any such argument. But to proceed to our zoological enumerations. To the upper region exclusively belong, among the Ruminants, the Bisons (*Poephagus*) and Musks, the wild goats (*Ibex*, *Hemitragus*) and wild sheep (*Pseudois*,

\* Last winter Dr. Hooker pointed out to me in the lower region a Hawthorn and a Horse Chesnut. But these are exceptional traits.

† For these tribes see J. A. S. for December 1847, and April and June 1848, and May 1849; also the prior paper in the same by Mr. Brown. Essay on the Kocch, Bodo, and Dhimal Languages and Literature of Nepal. Cunningham's History of the Sikhs, and Hamilton's Nepal. The Kholis of Kumaon are one of the tribes of Helot craftsmen of India, who are most of them Tamulian in origin, I think; but the subject is yet to be treated.

Ovis) among the Rodents, the Marmots and Pikas (*Lagomys*) ; among Plantigrades, the Bears proper (*Ursus*). In the middle region, true Bovines (*Bos*) take the place of the Bisons of the upper region ; Caprine Antelopes (*Nemorhædus*, *Kemas*) replace its Musks and wild goats and sheep ; common Rats, and Mice, and Hares, and Porcupines, and Hedgehogs, its Marmots and Pikas ; and sun Bears (*Helarctos*) its true Bears ; whilst the Deer family, unknown to the upper region, is here represented only\* by the anomalous stilt-horns (*Stylocerus*). In the lower region the ox family is represented by *Bibos* and *Bubalus* ; (splendid wild types) ; the deer family, here abundant, by *Rusas*, Stags, *Axises*, and stilt-horns to boot ; the Antelopes by *Tetracerus*, or the four-horned kind ; the Rodents by the *Bambú* rats (*Rizomys*) and spiny hares (*Caprolagus*) ; and the bear family by the honey bears (*Melursus*) ; add to all which that to this region are exclusively confined all the large *Pachydermes*, such as the Elephant and Rhinoceros ; and the Monkeys also (*Semnopithecus* et *Macacus*) though not so exclusively in their case. The carnivora, again, are represented in the upper region by ounces, by foxes of a large sort (*Montanus*), by the weasels proper, and by the *Ailuri* or Cat lories ; in the middle region by the wild Dogs (*Cyon*), the Marten weasels, leopards, thick-tailed leopards (*Macroceloides*), wild cats (*Murmensis*, *Pardochrous*, *Ogilbü*), Lybian lynxes (*Lybicus*). Zibets, Screwtails (*Paradoxurus*), and *Priodontons* ; and in the lower region by tigers, leopards, hyenas, wolves, jackals,† insectivorous foxes (*Kokri*), Bear badgers (*Ursitaxus*), *Urvas*, *Mangooses*, *Helictes* or Oriental gluttons, small civets (*Viverrula*), *Hirsute* screwtails, and shapfaced cats (*celidogaster*). Zibets recur in this region but rarely, and one small species of *Mongoose* is found in special spots of the central region. The otters in the upper region are represented by the small golden and brown species (*Aurobrunnea*) ; in the central, by *monticola* and *indigitata* ; in the lower, by the large

\* I am fully aware that *Rusas* (*Sámber*) are found in the western hills, but a careful consideration of the facts in that part of the *Himálays* with due advertence to the known habits of the group, satisfies me that these deer have been driven into the western hills by the clearance of the *Tarai* and *Bháver*.

† Jackals have made their way (like crows) to the most populous spots of the central region, but they are not proper to the region, nor Indian foxes, though some of the latter turned out by me in 1827 in the great valley of *Nepal*, have multiplied and settled their race there. *Ex his disce alia*.



Chinese species (*Sinensis*). Among the squirrels, the great thick-tailed and purple species (*Macuroïdes* et *Purpureus*) belong solely to the lower region; the small *Lokries* (*Locria* et *Locroïdes*) to the central; and the Siberian, to the upper; whilst flying squirrels, a numerous group, are confined to the central region, so far as appears. In the Bat group, the frugivorous species, or *Pteropines*, all are limited to the lower region, whilst the horse shoes (*Rhinolophinæ*) specially affect the central region; and the bats proper (*Vespertilioninæ*) seem to be the sole representatives of the family in the northern region. From the class of birds we may select as characteristic of the three regions the following:—

The true pheasants (*Phasianus*), the *Tetrougalli*, the sanguine pheasants (*Ithaginis*), the horned and the crested pheasants (*Ceriornis*, *Lophophorus*) of the upper region, are replaced by fowl pheasants (*Gallophasis*)\* in the mid-region, and by fowls proper (*Gallus*) in the lower. In like manner, among the partridges (*Perdiciinæ*), the grouse partridges (*Tetrauerdix*) belong exclusively to the upper region; the *chakórs* (*Caccabis*) and the tree partridges (*Arboricola*) to the central; and the *Francolines* (*Francolinus*) to the lower, though the black species of this last form are also found in the mid-region. In the pigeon group the blanced pigeons (*Leuconta*) belong solely to the upper region; the vinous pigeons (*Hodgsoni*) to the central, and the green, the golden, and the banded (*Treron*, *Chalcophaps*, *Macropygia*) as entirely to the lower; the *Trerons* alone partially entering the central tract from the lower.

The splendid *Edolian* shrikes (*Chibia*, *Chaptia*, *Edolius*) belong exclusively to the lower region. They are replaced in the central tract by plain *Dicrurines*, and in the upper, by plainer *Lanians*. The cotton birds (*Campephaga*) of the south are replaced by gaudy *Ampelines* (*Cochoa*) and *Leiiothricinians* (*Leiiothrix*, *Pteruthius*, *Cutia*) in the middle region: but both groups seem excluded from the north. Among

\* The influence of longitude on geographic distribution might be singularly illustrated, did space permit, from numerous Himálayan groups, Galline and other: thus, for example, a black-breasted *Ceriornis* is never seen east of the *Káli*, nor a red-breasted one west of it. So of the black and white crested *Gallophases*; whilst a black-backed one is never seen west of the *Arún*, nor a white back, east of it.

the Fly-catchers the gaudy or remarkable species and forms, belong wholly or chiefly to the lower region, as *Tchitrea*, *Rhipidura*, *Cryptolopha*, *Myiagra*, *Hemichelidon*, *Chelidorynx*; whilst those which approach the warblers (*Niltava*, *Siphia*, *Digenea*) belong to the mid-region; and the plainer and more European types are alone found in the northern.

Among the *Fissirostres*, Goat-suckers and Swallows are pretty generally distributed; but Rollers, Bee-eaters, *Eurylaimi*, Trogons and all such gaudy types belong to the south, with only occasional alpine representatives, as *Bucia* is of *Merops*. The *tenuirostral* birds belong distinctively to the lower region. Yet they have representatives or summer visitants in all three, even among the Sun-birds. Upon the whole however it may be safely said that the Sun-birds (*Nectarinia*) belong to the south; the Honey-suckers (*Meliphagidæ*) to the centre and south; and the Creepers, Nut-hatches and Wrens\* to the north and centre. The *Sylvians* or warblers are too ubiquitarian, or too migratory for our present purpose, even Boreal types being common in the lower region in the cold weather. Horn-bills, Barbets, Parroquets (*Palæornis*, *Psittacula*) belong to the lower region, though they have a few representatives in the central; none in the upper. Wood-peckers abound in the lower and central regions, but are rare in the upper. True Cuckoos (*Cuculus*) are as common and numerous in the central region as walking Cuckoos (*Phænicophaus*, *Centropus*), &c. are in the southern, where also the golden (*Chrysococcyx*) and dicurine Cuckoos (*Pseudornis*) have their sole abode, whilst what few of the group belong to the upper region, are all allied to the European type. The Ravens, Pies, Choughs, Nut-crackers and *Conostomes* of the upper region are replaced in the central region by Tree Pies (*Cissa*, *Dendrocitta*), Jays, Rocket birds (*Psilorhinus*), Pie thrushes (*Garrulax*), *Timalias*, and Hoopoe thrushes (*Pomatorhinus*); and in the lower region by the common Indian crows (*Culminatus et Splendens*), Grackles,† stares, vagabond pies

\* I have in this paper followed without entirely approving Mr. Gray junior's classification of my collections in the printed catalogue. The geographic distribution is now attempted for the first time. But I will recur to the subject in a separate paper devoted to it.

† When Darjiling was established there was not a crow or pastor to be seen. Now there are a few crows but no pastors. Enormously abundant as both are in

and dirt birds (*Malococercus*). Thrushes proper with rock thrushes, Ousels, Myophones, Zootheres, Tesias and Hypispetes are as abundant in the central and upper region as Bulbuls, Orioles, Pittas, are in the central and lower.

In the Finch family the Haw-finches, Bull-finches, Gold-finches and Cross-bills (*Loxia*) are as strictly confined to the upper region, as are the corvine Conostomes, Nut-crackers, Choughs and Ravens. The former are replaced in the central region by the Buntings, Wood-finches (*Montifringilla*), and Siskins; and in the lower region, by the Weavers and Mánias. The Raptorial birds are, in general, too cosmopolitan to subserve the purposes of Geographic distribution. Still it may be remarked that the true eagles belong, quoad breeding at least, to the upper region; the crested eagles (*Circæetus*), the Neopuses and Hawk eagles (*Spizaetus*) to the central; and the Pernes (*Haliæetus* et *Pandion*) and *Haliastur* to the lower. Among the vultures the distinction is more marked: for, the eagle vultures (*Gypætus*) belong exclusively to the upper region; the large European vultures (*Fulvus* et *Cinereus*) to the central; and the Neophrons, and the small Indian vultures (*Bengalensis* et *Tenuirostris*) to the lower. The Himálaya abounds in Falconidæ, all the occidental types and species being found there and many more, peculiar and oriental ones; and it deserves special remark that whereas the former (*Imperialis*, *Chryseetos*, *Lanarius*, *Peregrinus*, *Falumbarius*, *Nisus*, &c.) affect the upper and central regions, the oriental types (*Hypotriorchis*, *Haliastar*, *Jerax*, *Hyptiopus*, *Elanus*, *Poliornis*) are quite confined to the lower region.

Those perfect cosmopolitans the waders and swimmers, migrate regularly in April and October, between the plains of India and Tibet, and, in general, may be said to be wanting in the mountains though most abundant in the Tarai. The great Herons (*Nobilis* et *Cinereus*) the great Storks (*Nigra* et *Purpurea*) and great Cranes (the Cyrus and Damoiselle) of the Tarai are never seen in the mountains where the Egrets alone represent the first group. But the soft-billed smaller waders (*scolopacidæ*) are sufficiently common in the mountains, in which the woodcock abounds, breeding in the upper region and frequenting the central, and rarely the lower, region, from the lower region, this sufficiently proves they are not native to the central tract though common in the great valley of Nepal.

October till April. Geese, ducks and teals swarm in the Tarai, where every occidental type (so to speak, for they are ubiquitous) may be seen from October till April; and many oriental non-migratory types; whereas in the mountains the Mergansers (*orientalis*) and the Corvorrants (*Sinensis* et *Pygmæus*) only are found, and that very scantily; with a few Rails and Gallinules and Sandpipers, from the vast host of the Waders.\*

But I must hasten from these zoological details to make some remarks on the subdivisions of the lower region, a subject which, though in many ways interesting and important, is so little understood that the celebrated Mrs. Somerville in her very recent treatise of physical geography has represented the Tarai as being *within* not only the Bháver, but the sandstone range.†

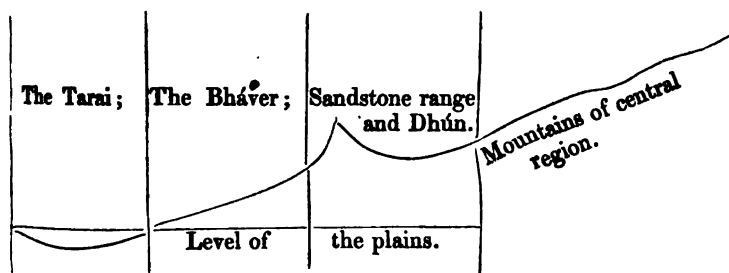
All observant persons who have proceeded from any part of the plains of India into the *Himálaya* are sensible of having passed through an intermediate region distinguished by many peculiarities; and, if their route have lain to the N. W., they can hardly have failed to notice successively the verdant Tarai, so unlike the arid plains of upper India; the vast primæval Saul forest; so every way unique; and the Dhúns or valleys, separated from the last tract by a low range of hills. The natives of the plains have in all ages recognised these several distinct parts of the lower *Himálayan* region which they have ever been, and are still, wont to frequent periodically, as strangers and foreigners, in order to graze innumerable herds of cows and buffaloes in the Tarai, or to procure the indispensable timber and elephants peculiar to the Bháver, or to obtain the much-prized drugs and dyes, horns and hides, (Deer and Rhinoceros), ráls and dhúnas (resin of Saul and of Cheer) and timber of the Dhúns. Nor is there a single tribe of Highlanders between the Cósi and the Sutledge which does not discriminate between the Tarai or Tari, the Jhári or Bháver, and the Dhúns or Máris. Capt. Herbert has admirably described‡ the geological peculiarities and external aspect of each of these well known tracts. His details are,

\* For an ample enumeration of the mammals and birds of the *Himálaya*, (150 sp. of the former, and 650 of the latter,) see separate catalogue printed by order of the Trustees of the British Museum in 1845. The distribution is not there given.

† Physical Geography, Vol. I. p. 66.

‡ J. A. S. No. 126, extra pp. 33 and 133, et seq.

indeed, confined to the space between the Káli and the Sutledge; but the general characteristics of these tracts he affirms to be equally applicable to all the country between the Méchi and the Sutledge; and Capt. Parish, whilst confirming Herbert's statements, makes them so likewise as far westward as the Beas.\* What Capt. Herbert states as holding good from his own personal researches in regard to the western Himálaya (Sutledge to Káli), I can confirm from mine in regard to the Nepalese portion (Káli to Mechi), but with this reservation, that no more in the western than in the Nepalese Himálaya does the sandstone range, with its contained Dhúns, prevail throughout or continuously, but only interruptedly or with intervals; and thus the Sallyán-mári, the Gongtali-mári, the Chitwan-mári, the Makwánpúr-mári and the Bijaypúr-mári of Népál (which are mostly separate) represent with perfect general accuracy the Deyra, Kyarda, Pinjor, Pítali and other Dhúns to the westward. The accompanying sectional outline will give a distincter idea than any words could do of the rela-



*Disposition of parts in lower region of Himálaya.*

tions of the several parts of the lower Himálayan region to the plains on the one hand, and to the mountains on the other, according to Capt. Herbert's views. The continuous basal line represents the level of the plains: the dip on the left, the Tarai; the ascending slope in the centre the Saul forest; the dip on the right, the Dhúns or Máris. It is thus seen that the Tarai sinks below the level of the plains; that the forest forms a gradual even ascent above that level; that the Dhúns

\* J. A. S. Nos. 190 and 202, for April 1848, and 1849.

continue the ascent to the base of the true mountains, but troughwise, or with a concave dip; and, lastly, that the *Dhúns* are contained between the low sandstone range and the base of the true mountains. *The Tarai* is an open waste, incumbered rather than clothed with grasses. It is notorious for a direful malaria, generated (it is said) by its excessive moisture and swamps—attributes derived, 1st, from its low site, 2nd, from its clayey bottom, 3rd, from innumerable rills percolating through the gravel and sand of the *Bháver*, and finding issue on the upper verge of the *Tarai* (where the gravelly or sandy debris from the mountains thins out), without power to form onward channels for their waters into the plains. *The forest* is equally malarious with the *Tarai*, though it be as dry as the *Tarai* is wet. The dryness of the forest is caused by the very porous nature of that vast mass of diluvial detritus on which it rests, and which is overlaid only by a thin but rich stratum of vegetable mould, every where sustaining a splendid crop of the invaluable timber tree (*Shorea robusta*), whence this tract derives its name. The *sandstone range* is of very inconsiderable height, though rich in fossils. It does not rise more than 3 to 600 feet above its immediate base, and is in some places half buried (so to speak) in the vast mass of debris through which it penetrates.\* *The Dhúns* are as malarious and as dry as the *Bháver*. They<sup>e</sup> are from 5 to 10 (often less, in one instance more) miles wide, and 20 to 40 long, sloping from either side towards their centre, and traversed lengthwise by a small stream which discharges itself commonly into one of the great alpine rivers; thus the *Ráputi* of *Chitwan-mári* falls into the *Gandak*, and that of *Bijaypúr-mári* into the *Cósi*. The direction of the *Máris* or *Dhúns* is parallel to the ghát line of the snows, and their substratum is a very deep bed of debris similar to that of the *Bháver*, but deeper, and similarly covered by a rich but superficial coating of vegetable

\* The low range which separates the *Dhúns* and *Tarai*, on the high road to *Kathmándú*, consists almost wholly of diluvium, rounded pebbles loosely set in ochreous clay, such as forms the great substratum of *Dhún* and *Bháver*. The sandstone formation only shows itself where the rain torrents have worn deep gullies, and it there appears as white weeping sand imperfectly indurated into rock. Anthracite, shale, loam, are found in this quarter, but no organic fossils, such as abound to the westward. Herbert assigns the *Siwálik*s to the new red formation of geologists. But if I understand *Lyll* rightly, that formation is inimical to fossils. Is there any mistake as to the technical class of rocks?

mould which, if not cultivated, naturally produces a forest of Saul equal to that outside the sandstone range, and then in like manner harbouring elephants, rhinoceroses, wild bulls (Bibos), wild buffaloes, rusas, and other large deer, with creeping things (Pythons) as gigantic as the quadrupeds. The height of the sandstone range Capt. Herbert estimates at 3000 feet above the sea, or 2000 above the plains adjacent; and that of the Dhúns (at least the great one), at 2500 above the sea, and 1500 above the plains. These measurements indicate sufficiently the heights of the lower region, and it is observable that no elevation short of 3 to 4000 feet above the sea suffices to rid the atmosphere of the lower Himálaya from malaria. Thus, the Tarai, the Bháver and the Dhúns are alike and universally cursed by that plague. And this (by the way) is one among several reasons why I have assigned 4000 feet of elevation as the southern limit of the healthful and temperate mid-region; that above it being the arctic or boreal, and that below it, the tropical, region; though it must never be forgotten that more or less of the tropical characters, especially in the suite of the seasons, pervades the whole breadth (and length likewise) of the Himálaya, whatever be the decrement of heat, and also that from the uncommon depth of the glens in which the great rivers especially run, and which in the Central and even Upper region often reduces the height of those glens above the sea below the limit just assigned for salubrity, such glens are in both these regions not unfrequently as malarious as is the whole lower region.

But, the above characteristics of the subdivisions of the lower Himálayan region, how noticeable soever to the west of the Méchi, are by no means so to the east of that river, where a skilled eye alone can painfully detect the traces\* of the sandstone formation (without which there can be, of course, no Dhúns,) and where the Tarai, considered as a trough running parallel to the mountains, forms no marked feature of the country, if indeed in that sense it can be said to exist at all.

\* In my recent expedition in the Tarai east of the Méchi with Dr. Hooker, that accomplished traveller first detected traces of the sandstone formation, with imperfect coal, shale, &c., in a gully below the Pankabári Bungalow, as well as at Lohagarh. The sandstone rock barely peeped out at the bottom of the gully lying in close proximity with the mountains, so that nothing could be more inconspicuous than it was as a feature in the physiognomy of the country.

And as, even to the westward, the sandstone range, with its contained Dhúns, is by no means constant, it may be desirable to attempt to characterise the lower region considered as a whole without reference to local peculiarities or too rigidly defined subdivisions. Now I conceive that the lower region owes its distinctive character as a whole to the vast mass of diluvial detritus which was shot from the mountains upon the plains, like gravel from a cart, at some great geological epoch, and which has been, since its deposit, variously and often abraded both in degree and direction, by oceanic, and, in a far less degree, by ordinary, floods. Where there was, at the epoch in question, no sandstone range to intercept the downward spread of the debris, this debris would necessarily be carried further south, and be of less thickness; where there *was* such a barrier, it would be carried less far southward and be accumulated in greater thickness, especially within the barrier; and, in like manner, where no sandstone range existed, but only spurs, sent forth, like bent arms, upon the plains from the mountains, the embayed detritus would still be deeply piled and lofty within such spurs,\* and thinly and unequally spread without them, by reason of the action of the spurs on the currents. Again, where, as from Gowhatty to Sadiá, there was not room upon the plains for the free spread and deposit of the descending Himálāyan detritus owing to large rapid rivers and to other chains, both parallel and proximate to the Himálāya, the phenomena created elsewhere by the more or less unrestricted spread of the Himálāyan detritus over the plains, would necessarily be faintly, if at all, traceable. Lastly, if at the time of the descent of the debris, there existed a great dip in the Gangetic plains from N. W. to S. E., the lithologic character, as well as the distribution, of the debris, would be materially affected thereby; for, the subsiding oceanic current would have a set from the former to the latter quarter, and would continue to lash

\* There is a signal example of this on the road to Darjiling viâ Pankabári where the debris, embayed by a spur, is accumulated to several hundred feet, and where moreover there is outside the spur a conspicuous succession of terraces, all due to oceanic forces, and clearly showing that the subsidence of the sea was by intervals, and not at once. Constant observation has caused the people of the Tarai to distinguish three principal tiers of terraces, from the prevalent growth of trees upon each. The highest, is the Saul level; the middle, the Khair level and the lowest, the Sissú level; Shorea, Acacia and Dalberga being abundantly developed on the three levels as above enumerated.



the gravel into sand, and here to deposit both in a series of terraces, there perhaps utterly to displace both, in the latter quarter long after the former had emerged from the waves. Now, that the Himálaya really was, at one time, in great part submerged; that the vast mass of detritus from the Himálaya at present spread over the plains in its vicinity, was so spread by the ocean when the founts of the deep were broken up; that this huge bed of detritus, every where forthcoming, is now found in unequal proportion and distribution and state of comminution; as, for example, deeper piled within, than without the sandstone range, and the embaying spurs, and also, more gravelly and abundant to the N. W., more sandy and scant to the S. E.;\* and, lastly, that the Gangetic plain really now has a great oblique dip† from the Sutledge at Rúper to the Brahmapútra at Gwálpára, whereby all the Himálayan feeders of the Ganges are in the plains so much bent over to the eastward—these are presumptions relative to the past as legitimate as the extant facts suggesting them are incontrovertible; and, we have but to observe how, at the grand epoch adverted to, the action of general causes was necessarily modified by the peculiar features of the scene, as above indicated, in order to come at a just conception of the aspect and character of the lower Himálayan region, all along the line of the mountains. Thus the longitudinal trough parallel to the mountains, and exclusively denominated the Tarai by Capt. Herbert, may to the N. W. have been caused by the set of the subsiding oceanic current from N. W. to S. E.; but, however caused, it exists as a palpable definite feature only beneath Kumáon; is

\* Capt. Herbert has given statements of its depth to the westward, where there is a sandstone range. To the eastward, where is none, I found it, on the right bank of the Tishta, under the mountains, 120 feet, at 15 miles lower down, 60 to 70 feet, at 15 miles still further off the mountains, 40 to 50 feet. There was here no interruption to the free spread of the detritus, and I followed one continuous slope and level—the main high one. The country exhibited, near the rivers especially, two or three other and subordinate levels or terraces, some marking the effect at unusual floods of extant fluvial action, but others unmistakeably that of pristine and oceanic forces. I measured heights from the river. I could not test the subsurface depth of the bed. There was every where much more sand than gravel, and boulders were rare.

† Saharunpúr is 1000 feet above the sea; Múradábád 600; Gorakpúr 400; Rangpúr 200; Gwálpára 112. My authorities are *As. Res.* Vol. XII. *J. A. S. No.* 126. *Royles Him. Bot.*, *Griffith's Journals*, and *J. Prinsep* in *epist.*

faintly traceable beneath Nepal, and is wholly lost beneath Sikim and Bhútán. But, the great bed of debris is *every where* present, and with no other distinctions than those pointed out, whether it be divided into Bháver and Dhún, by the sandstone range, as is usually the case west of the Méchi, or be not so divided owing to the absence of that range, as is always the fact east of the Méchi. Again, *every where* there is, at that point where this vast bed of gravel and sand thins out, a constantly moist tract, caused by the percolation of hill waters through the said bed, and their issue beyond it; and that constantly moist tract is the Tarai, whether it run regularly parallel to the line of mountains and be distinctly troughed, as to the westward is the case, or, whether there be no such regularity of parallelism or of troughing, as to the eastward is the case.

*Why* that vast mass of porous debris which every where constitutes the appropriated domain of the Saul forest, and that imporous trough outside of it which every where constitutes its drain, should, as far eastward as the Méchi, be both of them developed parallelly to each other and to the line of the mountains, whilst beyond the Méchi eastward to Assam (exclusive) they should exhibit little or no such parallelism, but should rather show themselves plainwards, like an irregular series of salient and resalient angles resting on the mountains, or like small insulated plateaux,\* or high undulated plains,† surrounded in both the latter cases by low swampy land analogous to the Tarai, it would require a volume to illustrate in detail. I have given a few conspicuous instances in the foot notes. For the rest it must suffice to observe that such are the general appearances of the Bháver and Tarai

\* Parbat Jowár, on the confines of Assam and Rangpúr, is one of the most remarkable of these small plateaux. It is considerably elevated, quite insulated, remote from the mountains, and covered with Saul, which the low level around exhibits no trace of. Parbat Jowár is a fragmentary relic of the high level or Bháver, to which the Saul tree adheres with undeviating uniformity.

† Conspicuous instances occur round Dinájpúr and N. W. and N. E. of Siligori in Rangpúr, where are found highly undulated downs, here and there varied by flat-topped detached hillocks, keeping the level of the loftiest part of the undulated surface. Looking into the clear bed of the Tishta it struck Dr. Hooker and myself at the same moment, how perfectly the bed of the river represented in miniature the conformation of these tracts, demonstrating to the eye their mode of origination under the sea.

to the westward and to the eastward; and that the general causes of the differences have been pretty plainly indicated above, where the necessary effects of the sandstone range and of the eastern dip of the plains upon those oceanic forces to which all the phenomena of the region owe their origin, have been suggested.

Throughout Assam, from Gwalpára to Saddia, Major Jenkins assures me there is neither Bháver nor Tarai; and if we look to the narrowness of that valley between the Himálaya and the mighty and impetuous Brahmaputra, and consider moreover the turmoil and violence of the oceanic current from the N. W., when its progress was staid by the locked-up valley of Assam, we shall be at no loss to conceive how all distinctive marks of Bháver and Tarai should here cease to be traceable.

It will be observed that in the foregone descriptions of our Himálayan rivers I have not adverted (save casually in one instance, in order to correct an error as to the true name of the Káli) to their partial trans-Himálayan sources. And I confess it seems to me that perspicuity is by no means served by undue insistency on that feature of our rivers. Capt. Herbert was thus led to travel beyond his proper limits with a result by no means favourable; for, it appears to me that he has confounded rather than cleared our conceptions of Asie Centrale as the Bám-i-dúnya (dome of the world) by attempting to detach therefrom that most characteristic part of it, the plateau of Tibet, *because* certain Indian rivers have (in part) Tibetan sources! My theory of watersheds does not incline me thus to violate the grander arrangements of nature, and the less so, inasmuch as the rivers I have to speak of would not afford so plausible an excuse for such violation, as if I had to treat of the Indus, Sutledge\* and Brahmaputra alias Sápú.† The Arún and the Karnáli, though they draw much water from Tibet, draw far more from the pente meridionale of the Himálaya, or the ghát line

\* Recte Satláj vel Satrúdra.

† Mr. Gutzlaff, in a paper recently read before the Geographical Society of London, has reverted to Klaproth's notion that the Sápú is not the Brahmaputra. But Mr. Gutzlaff has overlooked J. Prinsep's important, and I think decisive argument on the other side, viz., that the Brahmaputra discharges three times more water than the Ganges, which it could not do if it arose on the N. E. confines of Assam, notwithstanding the large quantity of water contributed by the Monás.

and all south of it; and this is yet more true of the Ganges, the Monás and the Tishta, though they also have partial trans-Himálayan sources. To those sources of the several Himálayan (so I must call them) rivers above treated of I will now summarily advert.

*The Mónás.*—It is by much the largest river of Bhútán, which state is almost wholly drained by it. It has, (it is said) two Tibetan sources, one from lake Palté vel Yarbro yum, which is a real lake, and not an island surrounded by a ring of water as commonly alleged—the other, from considerably to the west of Palté. These feeders I take to be identical with Klapproth's Mon tchú and Nai tchú vel Lúbnak tchú, strangely though he has dislocated them.

*The Tishta* is also a fine river, draining the whole of Sikim save the tracts verging on the plains. The Tishta has one Tibetan source, also from a lake, viz. that of Chólamú. To speak more precisely, there are several lakelets so named, and they lie close under the N. W. shoulder of Powhanry, some 30 miles W. and 40 S. of Turner's lakes.

*The Arún* is the largest of all the Himálayan rivers, with abundant cis-Himálayan and three trans-Himalayan feeders. One, the western, rises from the pente septentrionale of the Himálaya, in the district of Tingri; another, the northern, from a place called Dúrré; and a third, the eastern, from the undulated terraced and broken tract lying N. and a little W. of Cholamu, and S. of Kambala or the great range which bounds the valley of the Yaru on the S. from W. of Digarchi to E. of Lassa.

*The Karnáli* is much larger than the Alpine Ganges, and nearly equal to the Arún, perhaps quite so. It drains the whole Himálaya between the Nanda-dévi and Dhoula-giri peaks, and has one considerable Tibetan source deduced either from the north face of Himáchal near Momonángli or from the east face of that crescented sweep whereby Gangri nears Himáchal, and whence the Karnáli flows eastward to the Takla-khár pass.

*The Ganges* also has of late been discovered to have one Tibetan feeder, viz. the Jáhnvi, which, after traversing a good deal of broken country in Gnári between the Sutledge and the Himálaya, passes that chain at the Nilang ghát to join the Bhágarathi.\*

\* Moorcroft's Travels. J. A. S. No. 126, and I. S. R. Nos. 17, 18.

I will conclude this paper with the following amended comparative table of Andean and Himálayan peaks, Baron Humboldt having apprised me that Pentland's measurements, as formerly given by me, have been proved to be quite erroneous, and Col. Waugh having recently fixed Kangchang and Chumalári with unrivalled precision and accuracy.

<i>Chief Peaks of Andes. Feet.</i>		<i>Chief Peaks of Himalaya. Feet.</i>	
Aconcagua, . . . . .	23,000	Jamnoutri, . . . . .	25,669
Chimbarazo, . . . . .	21,424	Nanda-devi, . . . . .	25,598
Sorato, . . . . .	21,286	Dhoula-giri, . . . . .	27,600
Illimani, . . . . .	21,149	Gosain-than, . . . . .	24,700
Descabado, . . . . .	21,100	Kangchang, . . . . .	28,176
Desya-cassada, . . . . .	19,570	Chumalári, . . . . .	23,929

#### POSTSCRIPT.

That sensible and agreeable writer, Major Madden, in a letter just received by Dr. Hooker, notices "the disgraceful state of our maps of the Himálaya, which insert ridges where none exist, and omit them where they do exist; and, moreover, in regard to all names, show an utter ignorance of the meaning of Indian words." It is the express object of the above Essay to contribute towards the removal of the weightier of those blemishes of our maps without neglecting the lesser, by exhibiting, in their true and causal connexion, the great elevations and the river basins of the Himálaya. Major Madden supposes that the term Hyún dés, which he applies to Tibet, points to that region as the pristine abode of the Huns. But this is a mistake. Hyún dés is a term unknown to the language of Tibet. It is the equivalent in the Khas or Parbatia language for the Sanscrit Himyá dés, or land of snow. Its correlative term in the Parbatia tongue is Khas dés, or land of the Khas. The Khas race were till lately (1816) dominant from the Satlege to the Tishta: they are so still from the Káli to the Méchi. Hence the general prevalence of geographic terms derived from their language. By Hyún dés the Parbatias mean all the tracts covered ordinarily with snow on both sides of the crest or spine of Hemáchal, or the ghat line; and by Khas dés, all the unsnowed regions south of the former, as far as the sandstone range.

The bráhmans and those who use Sanscrit call the Hyún dés, Bhútánt or appendage of Bhót; and hence our maps exhibit a Bhútánt in

what Traill denominates (A. R. Vol. 16) the Bhote perganahs of Kú-máon. But, Bhútánt is not restricted by the bráhmans to such purganahs in Kú-máon merely, far less to any one spot within them. It includes all the districts similarly situated along the entire line of the Himálaya. We might create confusion however by recurring to this extended meaning of the word, since it has long been restricted by us to the Déb Rájah's territory, or Bhútán (recte Bhutánt). Moorcroft's Giannak in Western Tibet is the ne plus ultra of abuse of words. Far to the East, some Bhótia must have told him, lie the Giannak or Chinese, and thereupon he incontinently gives this term as a name of a place.

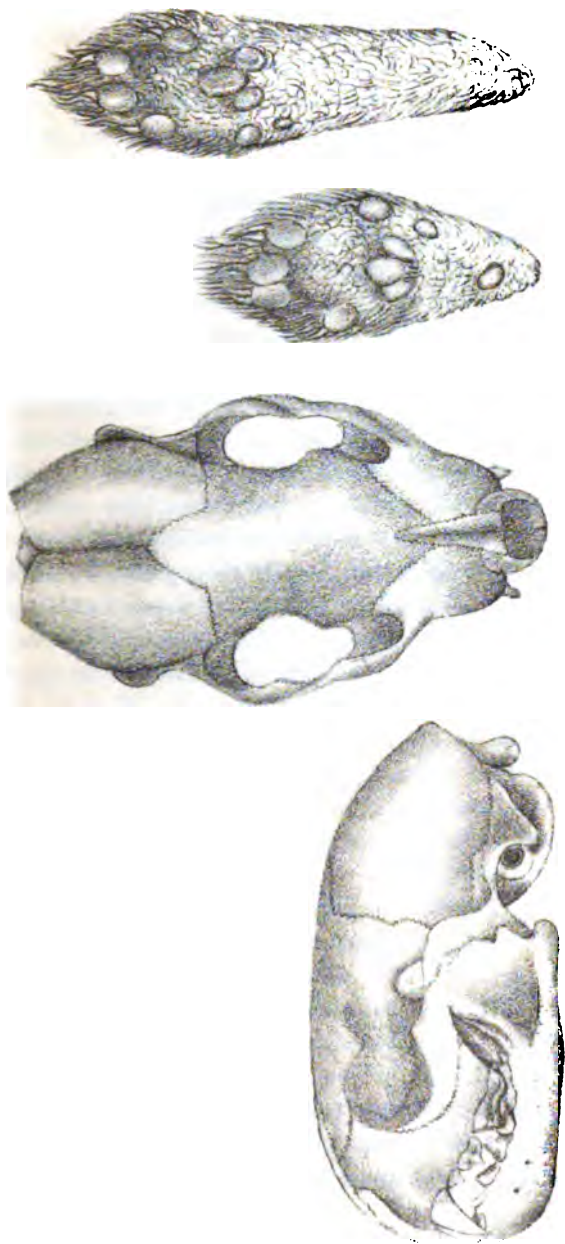
The Tibetans call their neighbours by the generic name Gia, to which they add distinctive affixes, as Gia nak, black Gias, alias Chinese; Gia-ver, red Gias, alias Russians; and Gia-gar, yellow Gias, alias Hindús. With reference to the Huns, if I were in search of *them* in Tibet, I should look for them among the Hór of that country, as I would for the Scythians among the Sóg vel Sók. Sogdiana or Sóg-land was, I conceive, the original *Saxea* the first known historic seat of the Indian Sákás and Tibetan Sóg, vel Sók. Hórsók as one term, means Nomade in Tibetan, such being still the condition of those two tribes in Tibet.

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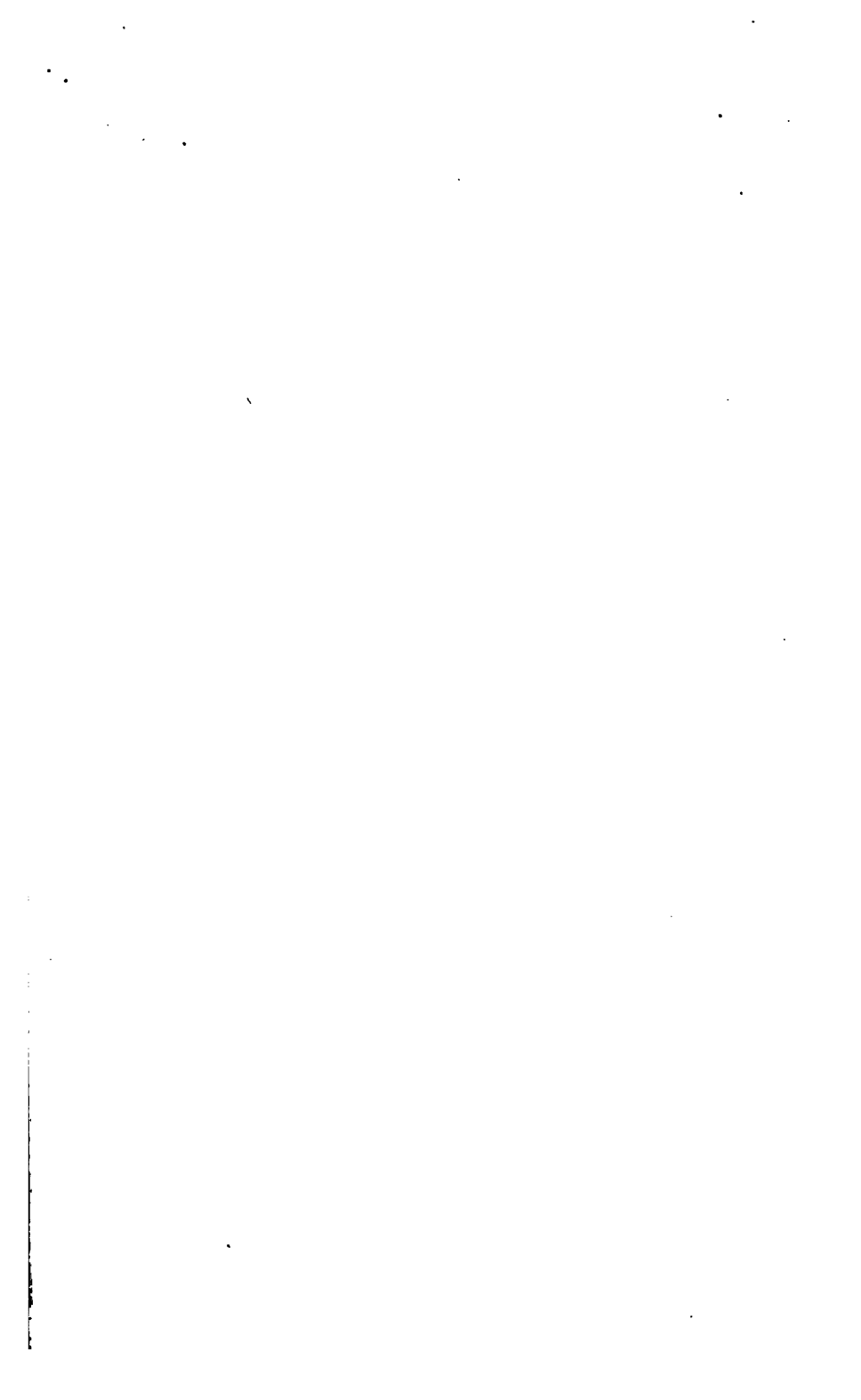
*On Native impressions regarding the Natural History of certain Animals, by H. TORRENS, Esq. B. A. V. P. &c.*

The singular impressions current among natives even of the highest rank, as to the habits and nature of certain animals are not undeserving of record. It is rarely that the credence of the narrators in these things can be elicited, if even they go so far as to mention the existence of the belief; for they dread the ridicule as much as they anticipate the incredulity of a European: consequently these strange stories are but imperfectly known, even to the best informed among us in such legends. I mention one or two with the circumstances of my acquaintance with them.

While out tiger-shooting with a party of Musalman gentlemen, I was asked, in a confidential way, whether I had ever seen the *phnew*: I spell the word with the almost undescribable nasal aspirate with which it was invariably pronounced to me. With an air of grave and serious interest, which is the best way of inspiring confidence, I replied that



**TIBETAN POLECAT.**





the nature of the thing or being, was unknown to me, and I requested information on the subject. On this there was a little hesitation, when after a time it was explained, that as I had seen more of tigers than my companions, they fancied I might have also seen or heard something of the animal that always preceded the tiger, called *phnew* from the ceaseless iteration of a sound similar to its name. I required further enlightenment as to this creature, when I found it was a "something that preceded the tiger by six cubits, wherever he went, making the noise *phnew* without end, looking for things for it." The old tales of 'the lion and his provider' recurred to me at once; and I bethought me of the hospitality of some cat-like sound of *felis tigris* having led, during his nightly search for prey, to the creation of the story. I have done all I could, but in vain, to discover whether there were real grounds for the belief, based on such a habit of the animal. I killed several tigers in company with my friends afterwards, but though we found no *phnew* with any of them, the silent faith of my believers in the marvellous, has remained unshaken as to the existence of the mysterious animal. I subsequently learned that there is in Bengal a like belief respecting it among the Hindus, who term the creature *ghóg*.\*

There are few Englishmen in India who have not perhaps heard some of the strange tales related by the natives regarding serpents. The most remarkable to me, has always been the belief in the *Raj Samp*, or king snake, who is represented as belonging to a superior order of serpent, as exacting homage and obedience from his ophite subjects, and, sometimes, as appearing with the semblance of a crown, the type of his authority. I was one day in company with a number of native gentlemen, when the conversation turned upon the nature of antidotes in the case of snake bites, the belief as to the cure effected, by applying to the wound, the head of the identical reptile that had inflicted it, the charms powerful to compel the snake to appear,—as to all which matters I have never been able to obtain, amid many tales, any relator daring enough to declare himself an eye-witness of the marvels he recounted. At last, mention being made of the King Snake, a party present said,—'At any rate I can assure you of the existence of *him*, for it is well known that I have seen,' and the story, to the following

\* According to Babu Rajendralál Mitra, the Hindus distinguish the *Ghóg* as a different animal from the *P'heu*.—E. B.

effect was then told. The narrator, being at that time he said, about fourteen years old, had run hastily to the terraced roof of a ground floor house to recover his kite, when his attention was attracted by a large *goomna* (cobra capello) which, without perceiving him, raised itself with dilated hood in the erect attitude common with those snakes, and uttered a loud cry. Immediately some ten or twelve snakes appeared from different quarters, and assembled before their king; when after a short time, he pounced upon, and devoured one of the smaller ones, with which arbitrary assertion of regal power the convocation terminated. Now the narrator of this tale had no interest in attempting to mislead me; he had mentioned what he stated again and again, to the majority of persons present for years, before I ever saw him; and he is naturally of intelligence, and in no sort the man to tell a useless falsehood. It is, I was then informed, by these sort of assemblages that the king snake asserts his power, and that his subjects are called to them for the purpose of bringing tribute, in the shape of dainties for the royal palate; should however no tributary frog or cat, or bird be forthcoming, or should even the offering produced be insufficient, one of the luckless ophids, pays in person the penalty of the omission,—even as had been witnessed by my informant.

I ventured with respect to his story to object, in as delicate a way as I could, to the incident of the cry uttered by the king snake, but in this I was immediately over-ridden. The cry of the large *goomna* was well-known in the ruinous city where we were, and in which they abound, and it was described to me as a strident sound, the attempted imitation of which resembled the acute staccato note of a treble hautboy. I heard this sound myself subsequently during a sleepless night, emitted by a large snake which killed a rat in my bed room: as it was pitch dark I was unable to rise and destroy the intruder, but the sound was too peculiar not to have been that of the ophid, according as it did with the description given me, and being unlike any thing I ever heard before, as also contrasting distinctly and remarkably with the cries of its victim.

I have noted down these trivial, but not incurious matters as an inducement to the record of more valuable facts as to the opinions held by natives upon the habits of animals, whence perhaps some really useful information may be elicited.

NOTE by Mr. Blyth.—The snake which I have had invariably pointed out to me, as the *Raj Samp* by natives of Bengal is *Bungarus annularis*, which habitually preys upon other snakes, and is currently said to be a deadly enemy of the Cobra. I have taken a *Tropidonatus umbratus* about two-thirds the length of its devourer, from the stomach of this species, and the specimen is stuffed in the Society's Museum as in the act of seizing its victim which it had swallowed. Another ophiophagous species with the Cobra hood, is *Hamadryas hannah* of Cantor, or *Maia vettata* of Elliot; a specimen of which (9 ft. long, and now mounted in the Museum), I obtained in the Midnapore jungle.

Mr. Layard some time ago informed me of a popular notion among the natives of Ceylon respecting a "horn" which is said to grow sometimes, but very rarely on the forehead of the jackal; and this horn is regarded by them as a specific of innumerable virtues. Strange to say, the same notion is equally current among the natives of Bengal, who believe that it ensures the prosperity of its possessor, and success in every undertaking.—E. B.

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*On the Influence of Forests on Climate.\** By Lieut. W. H. PARISH,  
B. A. (Communicated by Sir H. M. ELLIOTT, K. C. B. Sec. to the  
Govt. of India.)

The influence of forests in modifying the climate of the globe, may fitly be considered in this place, more especially as the subject has of late attracted much attention in this country. I shall confine myself however to merely recording in this brief notice the opinions of such scientific men as have devoted much of their time to the investigation of this important subject.

There can be no doubt that the state of the climate, especially the humidity of the atmosphere, influences vegetation, and that in its turn vegetation re-acts upon the climate, but too much importance has been attributed to the influence of forests, as if they were the principal cause of the moisture of the climate. The felling of forests has doubtless been attended, in many countries, by a diminution of rain, as in Barbadoes and Jamaica. In the Mauritius also, the rivers were found

\* This forms an Appendix to the Author's *Journal of a Trip to the Kohistan of the Jullunder* published in the April No. of the Journal.

to be diminishing on account of the rapid disappearance of the woods in the interior, when government had recourse to the measure of prohibiting their further destruction, and they rapidly recovered their former dimensions. In fact in all tropical countries, where the quantity of aqueous vapour in the atmosphere is great, but where on the other hand, the direct rays of the sun are most powerful, any impediment to the free circulation of the air, or any screen which shades the earth from the solar rays, becomes a source of humidity, and wherever dampness and cold have begun to be generated by such causes, the condensation of vapour continues. The leaves moreover of all plants are alembics, and some of those in the torrid zone have the remarkable property of distilling water, thus contributing to prevent the earth from becoming parched.

But there are various circumstances which may contribute towards the formation of rain, and to which I have alluded in the preceding remarks; temperature, pressure of the atmosphere and its electrical state, are the chief agents; mountain chains and forests form local causes.

The effect which forests exercise upon the condensation of vapours has been ably treated by Daniell, in his *Meteorological Essays*.

“Humboldt considers that forests exercise a triple influence upon climate—first they protect the soil against the rays of the sun; secondly, they produce, by the vital activity of their leaves, a constant evaporation of aqueous vapours; thirdly, these leaves increase the radiation. These three simultaneous causes, as affording shade, evaporation, and radiation, are so influential that the knowledge of the extent of forests compared with the naked savannahs, steppes and champaign ground, forms one of the most important elements in the climatology of a country. The active vitality of plants consists chiefly in the leaves; they are the organs of respiration, digestion and nutrition. The great quantity of water which they perspire may be easily proved by placing a glass next the under-surface of a young vine leaf on a hot day, and it will be found to perspire so copiously, that the glass will be in a short time covered with dew, which runs down in streams in half an hour. Hales computed the perspiration of plants to be seventeen times more than the human body; he calculated that the leaves of a single helianthus, 3 feet and  $\frac{1}{2}$  in height, covered 40 square feet, and comparing his former

observation of the perspiration of leaves with this circumstance, Humboldt observes properly, if a plant of such small size exercises influence upon evaporation, how much greater must be the perspiration of the forests of the Upper Orinoco, which cover 2,60,000 nautical square miles! The cloudy and misty sky of those regions, and of the Province of Las Esmeraldas, to the west of the Volcano of Pichinche, the decrease of the temperature in the missions on the Rio Negro, and the streams of vapour which become visible on fixing the eyes on the tops of the trees in the Equatorial forests, must be alike ascribed to the aqueous exhalation of the leaves and to their radiation towards the space of the atmosphere. \* \* \* \* \*

"It is asserted that there is at present much less rain in Barbadoes than there was formerly, and many of the inhabitants ascribe it to the unlimited clearance of forest and brushwood, and although we have no direct reasons to prove why such clearances lessen the annual quantity of rain, we have abundant proof that it is so. In every instance and in every part of the globe where forests have been cleared, a diminution of aqueous precipitations has been noted; and as it is a fact which remains uncontested, that Barbadoes, within the last fifty years was much more wooded than it is now, the diminution of rain must likewise be expected as the natural effect. The evidence of Humboldt, Leopold de Buck, Daniell, Dove, and others, is so powerful on this subject, that I should wish to press particularly upon the attention of the reader how important the existence of wooded spots become to the agriculturist. I cannot do better than quote the words of Humboldt to enforce this view:—"By felling the trees that cover the tops and the sides of mountains, men in every climate prepare at once two calamities for future generations—the want of fuel and a scarcity of water; trees, by the nature of their perspiration, and radiation from their leaves in a sky without clouds, surround themselves with an atmosphere constantly cool and misty."

Again, that forests exist in those parts only where the predominant winds carry with them a considerable quantity of moisture, and consequently that they are not the primary cause of humidity, is rendered highly probable from the following consideration:—

"\*In all countries having a summer heat exceeding 70° the pre-

\* Maclaren, *Art. America. Encyc. Britannica.*

sence or absence of natural woods, and their greater or less luxuriance, may be taken as a measure of the amount of humidity, and of the fertility of the soil; short and heavy rains in a warm country will produce grass, which having its roots near the surface springs up in a few days, and withers when the moisture is exhausted, but transitory rains, however heavy, will not nourish trees, because, after the surface is saturated with water, the rest runs off, and the moisture lodged in the soil neither sinks deep enough, nor is in sufficient quantity to furnish the giants of the forest with the necessary sustenance. It may be assumed that 20 inches of rain falling moderately, or at intervals, will leave a greater permanent supply in the soil than 40 inches falling as it sometimes does in the torrid zone in as many hours."

"In all regions," he continues, "where ranges of mountains intercept the course of the constant or the predominant winds, the country on the windward side of the mountains will be moist, and that on the leeward dry, and hence parched deserts will generally be found on the west side of countries within the tropics, and on the east side of those beyond them; the prevailing winds in these cases being generally in opposite directions. On this principle the position of forests in North and South America may be explained. Thus for example, in the region within the thirtieth parallel, the moisture swept up by the trade wind from the Atlantic is precipitated in part upon the mountains of Brazil, which are but low and so distributed as to extend far into the interior. The portion which remains is borne westward, and losing a little as it proceeds, is at length arrested by the Andes, where it falls down in showers on their summits. The Aerial current, now deprived of all the humidity with which it can part, arrives in a state of complete exsiccation at Peru, where consequently no rain falls. In the same manner the Ghauts in Hindoostan, a chain only three or four thousand feet high,\* intercept the whole moisture of the atmosphere, having copious rains on their windward side, while on the other the weather remains clear and dry. The rains in this case change regularly from the west side to the east, and vice versâ with the monsoons. But in the region of America, beyond the thirtieth parallel, the Andes serve as a screen to intercept the moisture brought by the prevailing winds from the Pacific Ocean; rains are copious on their summits, and in

\* Five or six thousand?

Chili on their western declivities, but none falls on the plains to the eastward except occasionally, when the wind blows from the Atlantic."

Again, Dr. Daubeney has ascertained by experiments communicated to the British Association, that plants undoubtedly exercise a purifying influence on the atmosphere. In a letter to Dr. John Lindley, he expresses himself thus :\*—

"As the observations of Ellis left it in some doubt whether the balance was in favour of the purifying or the deteriorating influence upon the air which is exercised by plants during different portions of the day and night, I conducted my experiments in such a manner that a plant might be inclosed in a jar for several successive days and nights, whilst the quality of the air was examined at least two or three times a day, and fresh carbonic acid admitted as required. A register being kept of the proportion of oxygen each time the air was examined, as well as of the quantity of carbonic acid introduced, it was invariably found that, so long as the plant continued healthy, the oxygen went on increasing, the diminution by night being more than counter-balanced by the gain during the day. This continued until signs of unhealthiness appeared in the confined plant, when of course the oxygen began to decrease."

"In a perfectly healthy and natural state, it is probable that the purifying influence of a plant is much greater, for when I introduced successively different plants into the same air, at intervals of only a few hours, the amount of oxygen was much more rapidly increased, in one instance to more than 40 per cent. of the whole, instead of twenty as in the air we breathe."

"Thus the vegetable kingdom may be considered as a special provision of nature to consume that which would render the world uninhabitable by man, and to have been so beautifully contrived that its existence depends upon its perpetual abstraction of that, without the removal of which our own existence could not be maintained. But although this is true of green plants, it does not appear to be so, of Fungi. Marcet has shewn from carefully conducted experiments, that Mushrooms, vegetating in atmospheric air, produce on that air very different modifications from those of green plants in analogous situations, in fact, that they vitiate the air promptly, either by absorbing

\* Vide Lindley's Introduction to Botany, p. 378, 3rd Edition.

its oxygen to form carbonic acid at the expense of the carbon of the vegetable, or by disengaging carbonic acid formed in various ways. That the modifications which the atmosphere experiences when in contact with growing mushrooms are the same day and night. That if fresh mushrooms are placed in an atmosphere of pure oxygen, a great part of that gas disappears at the end of a few hours. One portion of oxygen which is absorbed combines with the carbon of the plant to form carbonic acid, whilst another part appears to be fixed in the vegetable, and to be replaced, at least in part, by nitrogen disengaged by the mushroom. That when fresh mushrooms remain some hours in an atmosphere of nitrogen, they modify but slightly the nature of that gas. The sole effect produced is confined to the disengagement of a small quantity of carbonic acid, and sometimes to the absorption of a very small quantity of nitrogen."

No application of human skill and labour tends so greatly to vary the state of the habitable surface, as that employed in the drainage of lakes and marches, since not only the localities of many animals and plants, but the general climate of a district, may thus be modified. There seems little doubt that in the United States the rapid "clearing" of the country has rendered the winters less severe and the summers less hot, in other words the extreme temperatures of January and July have been observed from year to year to approach somewhat nearer to each other, and thus most probably, the mean temperature has been raised. The same result has been brought about in this country, only to a much greater extent.

The entire destruction of all woods and forests has rendered India liable to those dreadful calamities which always follow a deficiency of rain.

The N. W. Provinces were denuded of their trees during the wars that attended the decline and fall of the Muhammedan Empire, and the rise and progress of the Jats, Seikhs and Mahrattas. These lawless freebooters swept away all the groves from the face of every district they invaded, whilst they never thought of renewing them, or encouraging their renewal, in those countries which they permanently occupied; many fertile regions were thus turned into dreary and arid wastes.

It is marvellous to think how slowly and reluctantly the Indian Government has come forward and acknowledged the necessity for that merciful provision of nature by which the thirsty soil is refreshed with grateful drafts and rendered habitable by man. Trees perform as



important functions, and are as indispensable in the economy of nature as the liquid air which encircles our globe, or the mighty ocean which lashes its shores.

"The carbonic acid with which our breathing fills the air, to-morrow will be spreading north and south and striving to make the tour of the world. The date trees that grow round the fountains of the Nile will drink it in by their leaves; the Cedars of Lebanon will take of it to add to their stature, the cocoa-nuts of Tahiti will grow riper upon it, and the palms and bananas of Japan will change it into flowers."

"The oxygen we are breathing was distilled for us some short time ago by the magnolias of the Susquehanna and the great trees that skirt the Orinoco and the Amazon. The giant rhododendrons of the Himalayas contributed to it, the roses and myrtles of Cashmír, the cinnamon trees of Ceylon, and forests older than the flood, buried deep in the heart of Africa far behind the mountains of the moon. The rain which we see descending was thawed for us out of icebergs which have watched the polar star for ages, and lotus lilies sucked up from the Nile and exhaled as vapour the snows that are lying on the tops of our hills."\*

Among the many causes which produce certain modifications in the climate of any region, and one which is too frequently overlooked, is the *nature of the soil*. This is principally owing to the greater or less power any soil possesses of radiating heat. Thus sandy soils are subject to become rapidly and intensely heated, and when the rays of the sun are withdrawn, they readily radiate or impart to the atmosphere the heat they have acquired, thus increasing the general temperature. Clayey soils on the other hand become slowly heated, and as slowly part with heat; swampy ground chills the air, and extensive forest tracts have a similar effect. And thus cultivation not unfrequently effects a change in the climate of a country, for if marshes are drained, or forests cleared, the temperature will be raised. It thus appears that the diversities of climate are brought about by various causes, and are chiefly dependant on latitude; on the distribution of land and water; on the elevation of land above the sea, as also on the nature of the soil, the prevalence of particular winds, and position of forest, on currents of the ocean, on the direction and extent of mountain ranges, and many other local circumstances.

\* British Quarterly Mag.

The present denuded state of the N. W. Provinces has, I believe, lately attracted the attention of government, and therefore it may not be amiss to note down here the plans that have suggested themselves for restoring to the soil what nature designed for its protection and benefit.

In the first place it appears necessary that the government should set the good example to its subjects by cutting canals, planting trees and digging wells at every ten or twelve miles along the principal thoroughfares of these provinces; and moreover it should adopt measures for their protection, and prevent the groves from being destroyed for the purposes of feeding camels and elephants, as well as for supplying fuel for Military Stations.

The extensive dawk (*Butea frondosa*) jungle, situated between Phugwara and Khanoora, in the Jullundhur Doab, is fast disappearing, and in a very few years no traces of it will be left. The same may be said of the pine forests in our Himalayan Provinces.

On each occasion that I have marched through the above mentioned Doab, I have been sorely grieved to mark how the venerable peepal and banyan trees planted for the purpose of affording shade to the weary traveller, have been ruthlessly mutilated in order to feed the camels and elephants belonging to Europeans and the government. That picturesque Doab will soon become as dreary and as naked as any of the Upper Provinces, if some protecting hand is not immediately stretched out to prevent its spoliation. In the next place, the government should foster and encourage, or rather turn to some useful purpose the religious vanity of the Hindus, by granting them certain portions of rent-free land in perpetuity whereon to plant groves and dig wells for the benefit of their souls, and to the greater advantage of travellers.

“To live in the grateful recollections of their countrymen for benefits conferred upon them in great works of ornament and utility, is the study of every Hindu of rank and property. Such works tend in his opinion, not only to spread and perpetuate his name in this world, but through the good wishes and prayers of those who are benefitted by them, to secure the favour of the deity in the next.

“According to their notions every drop of rain water or dew that falls to the ground from the green leaf of a fruit tree, planted by them

for the common good, proves a refreshing draft for their souls in the next. When no descendants remain to pour the funeral libation in their name, the water from the trees they have planted for the public good is destined to supply its place ; every thing judiciously laid out to promote the happiness of their fellow-creatures will in the next world be repaid tenfold by the deity.”\*

“If government wishes to have the Upper Doab, the Delhi, Muttra and Agra districts again enriched and embellished with mango groves, they will not delay to convey this feeling to the hundreds, nay thousands who would be willing and anxious to plant them upon a single guarantee that the lands upon which the trees stand shall be considered to belong to them and their heirs as long as these trees stand upon them. That the land, the shade, the fruit, and the water will be left to the free enjoyment of the public, one may take for granted, since the good which the planter’s soul is to derive from such a work in the next world must depend upon their being so ; and all that is required to be stipulated for in such grants, is that mango, tamarind, peepul or bur trees, at the rate of twenty-five the English acre, shall be planted and kept up in every piece of land granted for that purpose ; and that a well of pukka masonry shall be made for the purpose of watering them, in the smallest as well as in the largest piece of ground granted, and kept always in repair.

“If the grantee fulfil the conditions, he ought, in order to cover part of the expense, to be permitted to till the land under the trees until they grow to maturity and yield their fruit ; if he fails, the lands, having been declared liable to resumption, should be resumed.

“The person soliciting such grants should be required to certify in his application that he had already obtained the sanction of the present lessee of the village in which he wishes to have his grove, and for this sanction he would of course have to pay the full value of the land for the period of his lease. When his lease expires, the land in which the grove is planted would be excluded from the assessment ; and when it is considered that every good grove must cost the planter more than 50 times the annual rent of the land, government may be satisfied that they secure the advantage to their people at a very cheap rate.”†

\* *Rambles and Recollections of an Indian Official*, p. 191, Vol. 2.

† *Ibid*, p. 197, Vol. 2.

*A Supplemental Note to the Catalogue of the Birds in the Asiatic Society's Museum;\** by E. BLYTH, Esq.

No. 1818. *CACATUA CITRINO-CRISTATA*; *Plyctolophus citrino-cristatus*, Fraser, P. Z. S. 1844, p. 39. Except that Mr. Fraser states that this species is about the size of *C. sulphurea*, his description of it would equally apply to *C. galerita*, which indeed it very closely resembles, except in its much inferior size. It is larger, however, than *C. sulphurea*, and has a much higher crest; while its beak is considerably smaller and more compressed than in that species, having a much narrower culmen to the upper mandible, but the lower being as broad as in *C. sulphurea*, with a medial groove instead of a convexity. Colour exactly as in *C. galerita*; and length of closed wing  $10\frac{1}{2}$  in., and of crest  $4\frac{1}{2}$  in. Habitat unknown.

No. 1833. *PALÆORNIS CALTHRAPÆ*, Layard. A beautiful species, the representative in the mountainous parts of Ceylon of *P. columboides* of the Nilgiris, to which species it manifests the nearest affinity. Crown and back plumbeous-grey, passing to bluish on the rump, and rich dark indigo-blue on the middle tail-feathers and outer webs of the rest: tail yellow beneath and at the tips, sullied along the inner webs of the rectrices above: forehead and cheeks (passing beyond the eye), broad nuchal ring, and entire under parts, brilliant green: wings deeper green, paler and yellowish towards the scapularies: throat intense black and contrasting; with a tendency to form a ring round the neck, but which does not so much as half surround the neck. Upper mandible bright coral, with a white tip; the lower reddish. Wing  $5\frac{1}{2}$  in.: tail probably of the usual length, but its medial feathers in the specimen described appear but half-grown. A female or young male is wholly green, more yellowish below, except the rump which is brighter blue than in the adult male, and the tail is mingled green and indigo-blue; the more vivid green ring of the neck but obscurely indicated. Both the mandibles are dull coral, with white tips; and the wing measures  $5\frac{1}{2}$  in., the tail but  $4\frac{1}{2}$  in.

\* The species included in this paper are, almost without exception, comprised in the printed Catalogue of the collection of Birds in the Society's Museum, each with a reference to Vol. XVIII, of its Journal, and their numbers in the Catalogue are here prefixed.

Inhabits the Kandyan country, in Ceylon. Nothing can exceed the harmony and delicate beauty of its colouring.

No. 1820. *LORICULUS ASIATICUS*; *Psittacus asiaticus*, Latham, and *Ps. indicus*, Gmelin,—both founded on Edwards, pl. 6, which is a good representation. The names, however, are bad, as the race would seem to be wholly confined to Ceylon: while *L. vernalis* inhabits all India, and the countries bordering the eastern shores of the Bay of Bengal, as far as the Tenasserim provinces where it abounds, and also Java; whereas in the Malayan peninsula there appears only to be *L. pulchellus*. *L. asiaticus* differs from *L. vernalis* in having the crown deep red, passing to a saffron hue on the nape, and in some specimens over much of the back; while the fore-part of the neck is tinged more or less deeply with verditer. The nearest affinity of these Loricules is with the genus *Eclectus*;\* and there are other species in the Philippines and probably the south of China.

No. 99. *MICRASTUR*—? Size of full grown young male *Asitur pulcherrimus*, and plumage scarcely differing; but the tail shorter, and the tarse longer and more slender. The markings of the under-parts are also less narrow, forming pear-shaped drops, small and rounded on the belly, lower tail-coverts, and tibial plumes,—much as in the young *M. badius*: under surface of the primaries (as seen in the closed wing) almost unbarred; their emarginated portion plain brown; the rest of the inner webs having narrow bars, which are distinct from the fifth inwards and throughout the secondaries and tertiaries; above, the primaries are albescent-rufous at base, with their outer webs barred from the third inwards: tail with numerous (8 or 9) transverse dark bands, narrow towards its base and broadening to the last; the longer upper coverts of the tail also distinctly banded. Length of closed wing 13 in.; of tail 9 in.; and tarse 3 in., the latter plumed for about  $\frac{1}{4}$ . Habitat unknown: not improbably American.

No. 171, *d*; p. 340: and No. 172. *STRIX FUSILLA*, nobis. Distinguished at a glance from *Str. flammea* by its general smaller size, conspicuously smaller facial ruff, and shorter and more slender tarsi and toes. A specimen received from England (but not supposed to be Eng-

\* *Psittacus sumatrensis*, Raffles, erroneously referred by Mr. G. R. Gray to this genus, seems merely to be the female of *Tanygnathus macrorhynchos*, which is closely allied to *Palaornis*.

lish) was doubtfully referred to the Australian *Str. delicatula*, Gould, in *J. A. S.* XVII, 346 ; but Mr. Strickland (*in epistola*) assures me that it is not *delicatula*. Another, like it, but  $1\frac{1}{4}$  in. longer in the wing, has since been received from Mr. Layard, who informs me that this specimen came from Egypt : but the latter may either exhibit the extreme of variation of colouring as compared with the former, or they may be of two small races closely affined to each other and to *Str. flammea*, in which case the name *parva* may be bestowed on the Egyptian race, and *pusilla* on the other (the habitat of which is unknown). The latter, or that formerly described, resembles the most ashy specimens of *Str. flammea* above, except that the white spots bordered with black are less defined ; and below it is white, with the usual small blackish dots : primaries and tail barred exactly as in several specimens of *Str. flammea* with which we have compared it. The Egyptian specimen resembles the more fulvous examples of *Str. flammea* above, having much less of the ashy mottling than the other ; below it is white with minute dusky specks ; and the outermost and penultimate tail-feathers are wholly unbarred underneath, causing the lower surface of the tail to appear quite white : the primaries are very faintly banded on their outer webs, but the bars on their inner webs are unusually black ; and the bands upon the tail as seen above are much more faint than usual. In both, the tarsi measure but  $2\frac{1}{4}$  in. (instead of  $2\frac{1}{2}$  in. and upwards), and are conspicuously less robust than in *Str. flammea*. Notwithstanding the differences of the two specimens, we suspect that they pertain to the same small race or species.

No. 178. *BUCEROS AFFINIS*, Hutton. This perfectly resembles *B. albirostris* (No. 179), except that it is constantly of the considerably larger size of *B. pica* (No. 177). Inhabits the Deyra Doon. The large bill and casque noticed in XVI, 994, pertain decidedly to this race.

There are accordingly now the following series of species or permanent races liable to be confounded together under *B. pica* vel *malabaricus*, auctorum.

1. *B. pica* (No. 177). Distinguished by its comparatively large size, highly compressed casque with great black patch not descending upon the upper mandible, and four white tail-feathers on each side. Inhabits all the peninsula from central India southward, and Ceylon ? At least a head from the latter country is undistinguishable ; but the Cinghalese

race (*B. violaceus*, auct.,) is described to have constantly only three of its outer tail-feathers on each side white.

2. *B. albirostris*, Shaw (No. 179), vide *J. A. S.* XVI, 994. From Bengal, Nepal, Asám, Sylhet, Arakan, and the Tenasserim provinces. Great numbers of specimens examined, present no remarkable variation of size, and certainly never approach the dimensions of the Deyra Doon race.

3. *B. affinis* (No. 178).

4. *B. intermedius*, nobis (No. 180), vide *J. A. S.* XVI, 994. Like No. 179, but with the tail of No. 177. This race is very abundant about Pinang, but we have never seen it from Malacca or Singapore. It is probably the Sumatran *malabaricus* of Raffles, the Javanese *albirostris* of Horsfield, and the general Malayan *malabaricus* of Temminck and others.

5? *B. violaceus*, Shaw, and of Wagler? (*Non vidimus.*) From Ceylon.—*B. malayanus* (No. 181) is also nearly affined, but too different to be confounded with either of the others; and *B. nigrirostris* (No. 182) is certainly distinct, and is referred to by Dr. S. Muller as a permanent variety of No. 181.\*

Genus *Picus*, L., as restricted to the pied species forming the division *Dendrocopus* of Swainson. The Indian species of this group are treated of in XIV, 196, so far as we were then cognisant of them. We have since learned of two others described from the "Himalaya," viz. *P. assimilis*, Natterer,—like *P. himalayanus* (No. 287), but with the scapulary feathers white, and some other distinctions,—and *P. scintilla*, Lichtenstein,—which considerably resembles *P. pygmaeus* (No. 300), except in being very much larger. We have now to add

No. 1825. *P. ATRATUS*, nobis. Resembles *P. Macci*, but is larger, with no fulvescent-white on the sides of the head and neck, except some admixture of it on the lores, ear-coverts, and above the eye. Lower-parts black, the feathers laterally edged with dingy golden-fulvous, confused and intermixed on the abdomen, and the black gener-

\* This author gives four varieties of *B. rhinoceros*, respectively from Sumatra, Borneo, India (about Seringapatam), and Java. We doubt altogether the occurrence of this bird in India proper, and may remark that a Javanese female examined differed in no respect from the common Malayan peninsula race, which is identical with Dr. S. Muller's Sumatran variety.

ally prevailing; lower tail-coverts crimson, and probably the crown also of the male. Four middle tail-feathers black, the white less developed on the others than in *P. Macei*. Length probably about 8 in.; of wing  $4\frac{1}{2}$  in.; span of foot  $1\frac{1}{2}$  in.; beak from forehead  $1\frac{1}{2}$  in. Inhabits the Tenasserim provinces.

Four nearly affined species exist in *P. atratus*, *P. Macei*, *P. analis*, and *P. pectoralis*, nobis, *J. A. S.* XV, 15. The last would seem to approximate very nearly *P. analis*, Horsfield, vel *Wagnerii*, Hartlaub; but it has merely a very faint tinge of red on the lower tail-coverts.

No. 304. *P. GYMNOPHTHALMOS*, nobis. This little Woodpecker so nearly resembles *P. moluccensis* (No. 301), that the same description of the upper-parts would nearly serve for both; but the under-parts are *streakless* rufescent-white, except the lower tail-coverts which have blackish centres. The crown also differs in being of an uniform sooty-black, a little brownish towards the lores only; the outer webs of the primaries are wholly dusky-black without markings; and all the tail-feathers have series of two or three white spots along the border of each web, not developed into bands. The black generally is also more intense than in *P. moluccensis*; and there is a small naked orbital space, less developed in *P. variegatus*. We have only seen the female, but Mr. Layard informs us that the male has "a slender brilliant crimson ear-stripe."

Inhabits Ceylon; where generally observed singly upon dead trees. (Layard.)

No. 299. *P. RUBRICATUS*, nobis. The male of this was described as a particularly fine old male of *P. pygmaeus* (No. 300) in *J. A. S.* XIV, 197; but we have since seen many specimens of *P. pygmaeus* from the N. W. Himalaya, none of which had the crimson sincipital tuft more developed than in *P. moluccensis*; whereas of numerous examples of the present bird from Darjiling, the males had invariably this crimson much more developed, in some forming a broad occipital band completely across, and in all tending more or less to do so, the lateral portions being generally (though not always) more developed than the medial. There is no other difference, and the females are absolutely alike. The specimens which Mr. Hodgson sent from the intermediate country of Nepal were all true *P. pygmaeus*, and Capt. Hutton assures us that he never saw the sincipital tuft of the N. W. race developed as in that of Sikim.



No. 305. *P. VALIDIROSTRIS*, nobis. Described and erroneously referred to *P. nanus*, Vigors, in *J. A. S.* XIV, 197; *P. nanus* being a synonyme of *P. variegatus*, Wagler (No. 303). It is probably from the Philippines or China.

No. 302. *P. CANICAPILLUS*, nobis. When I described this species in *J. A. S.* XIV, 197, I had not seen the true *P. moluccensis* which is common throughout the Malay countries, but followed Hardwicke and Gray in regarding the Indian *P. variegatus* as *P. moluccensis*. From the true *moluccensis*, *canicapillus* only differs in having the entire crown light brownish-grey, with only a little black margining the occiput; the ear-coverts are also pale brown instead of brownish-black, and the beak is chiefly or wholly whitish. These are slight distinctions, which can hardly be regarded as specific; and yet they appear to be constantly characteristic of the race from Arakan and Tenasserim, while the Malayan peninsula race is undistinguishable from that of Java.

No. 347. *CUCULUS TENUIROSTRIS*. In Lower Bengal, the majority of adults of this species have the lower-parts bright ferruginous: on the eastern side of the Bay of Bengal, all appear to be of this colour, and we have reason to infer that they grade insensibly into the smaller Malayan race (*C. flavus*) as we proceed southward, and the adults of that race we have never seen otherwise coloured. On the other hand, throughout the peninsula of India and in Ceylon, also in the Deyra Doon, the rufous-bellied specimens appear never to occur, and many are wholly dark ashy in Lower Bengal, while others from this vicinity exhibit every grade of intermediateness, having reference neither to age nor sex.

No. 386. *CENTROPUS CHLORORHYNCHOS*, nobis. Distinguished from *C. RUFIPENNIS*, Illiger (vel *philippensis*, Cuvier, No. 385), by its much shorter wings, and larger bill of an uniform greenish-yellow colour; by the darker shade bordering on marronne of the back and wings; and by the peculiar hue of the dark head, neck, and under-parts, which have a somewhat ruddy tinge, and are glossed with amethystine-purple, a redder shine of which is seen likewise to gloss the upper-parts: tail purple-black. Length about 18 in., of which the tail measures half, its outermost feathers  $9\frac{1}{2}$  in. less: wing  $6\frac{1}{2}$  in.; bill to gape  $1\frac{1}{2}$  in.; and its vertical depth fully  $\frac{3}{4}$  in.: tarse 2 in.; and long hind-claw about 1 in.

## Inhabits Ceylon.

No. 405. *BATRACHOSTOMUS AFFINIS*, nobis, *J. A. S.* XVI, 1180.

In a collection made at Darjiling, among a number of supernumerary fragments we found the heads, wings, and tails of two specimens of what we now consider to be the young of this species, especially distinguished from the adult by the slenderness of the bony rami of the lower mandible, as we find to be also the case with the young of *B. auritus* (No. 403). Each is in nestling garb, though the two are remarkably unlike; one being mainly of a light chesnut hue, with nearly obsolete barred markings, and throwing out deeper chesnut or light bay feathers on the crown and shoulder of the wing; while the other is profusely mottled throughout with black on a pale ground but faintly tinged with chesnut.

*B. MONILIGER*, Layard, *n. s.* A little smaller than *B. JAVANENSIS*, (Horsfield, No. 404), which it greatly resembles at the first glance, but differs considerably in the details of its markings. Colour of the upper-parts, throat and breast, bright bay or rufous-brown; the latter without spots, except a torque of white spots margined above with black above the breast, and another separating the hue of the breast from that of the abdomen; belly and lower tail-coverts contrasting pale isabelline, with similar but smaller spots, and a slight dusky mottling over the flanks: coronal feathers long, the occipital tipped with white bordered above with black, forming a white nuchal ring almost or quite continuous with the torque below: over the eye a pale rufescent supercilium; and the lengthened and erect loral plumes are tipped with black and whitish at the extreme tip: most of the wing-coverts are tipped with a large ovoid pure white spot bordered above with black; the tertiaries are pale and delicately mottled with dusky, each having also a minute terminal black and white spot; and the primaries are black having their outer webs broadly margined with the colour of the back; the scapularies also have small terminal black and white spots, and the uppermost are pale like the tertiaries: tail mottled and obscurely banded, the bands terminating externally in series of whitish spots, successively more developed and distinct on the outer feathers. In form the tail is somewhat peculiar, its lateral halves separating into distinct lobes, whence the closed tail appears furcate. Length about 10 in., of wing  $4\frac{1}{2}$  in., and tail  $4\frac{1}{4}$  in., its outermost feather  $2\frac{1}{4}$  in. less

penultimate 1 in. less, and ante-penultimate but  $\frac{1}{4}$  in. less. The uniform rufous-brown of the throat and breast, crossed by the white torque and bordered below by another, well distinguishes this species from *B. javanensis*; and the bright white spots on the wings (corresponding but not similar to those of the large *B. auritus*) distinguish it as readily from *B. affinis*. It remains to ascertain whether either *B. moniliger*, *B. affinis*, or *B. auritus*, presents the state of plumage corresponding to that named *Podargus cornutus* by M. Temminck, who considers this to be identical with *B. javanensis*, while Mr. G. R. Gray regards them as separate species. The dark young specimen of presumed *B. affinis* from Darjiling would seem to indicate, from its considerable resemblance to *cornutus*, that it would afterwards have assumed that dress, in which case it would seem to follow that the two are different phases of the same bird irrespective of age and perhaps sex. *B. moniliger* inhabits Ceylon, where Mr. Layard is informed that it is not uncommon at a particular altitude in the Kandyan country; and it is most probably the Coorg species seen by Mr. Jerdon, as noticed in XIV, 209.

The anatomy of this genus differs remarkably from that of *Caprimulgus*. The stomach is a highly muscular gizzard, like that of *Nyctibius*;<sup>\*</sup> and there is a large gall-bladder: sternum small, subquadrate, with but a slight keel, and four deep emarginations behind; the coracoids long and slender, and furcula like that of *Caprimulgus* but more slender. According to Mr. Gould, the outer front claw of *Podargus* is capable of reversion; but on macerating and completely relaxing the foot of *P. strigoides*, we found that it can be only half-reversed, as in *Corythaeis*, *Tamatia*, and some other genera. Save in the proportional size of the feet, which are much larger in *Podargus*, there seems to be nought else to separate *Batrachostomus* from it; and it is probable that even in this respect a gradation occurs in the different species.

No. 425. *CYPSELUS SUBFURCATUS*, nobis: *C. affinis*, var., apud Strickland, *P. Z. S.* 1846, p. 99. Resembles *C. affinis*, but is larger, deeper-coloured, with the tail-feathers conspicuously more pointed, and the outermost measuring  $\frac{1}{4}$  in. longer than the middle ones. Wing  $5\frac{1}{4}$  in.; tail  $2\frac{1}{2}$  in. General colour much blacker than in *C. affinis*, the upper and lower tail-coverts being quite black; the white band on the

<sup>\*</sup> Gosse's 'Birds of Jamaica,' where the habits of the excessively long-winged *Nyctibius* are described as much more those of *Podargus* than of *Caprimulgus*.

rump is narrower and less purely white; and the white of the throat is also less pure. The nidification is also remarkably different: several pairs inhabiting a continuous common nest, which is affixed to an cave in the manner of that of *Hirundo urbica*, or of *Cypselus affinis*; the latter species, however, (so far as we have observed,) so placing its nest as to be concealed or at least rendered inconspicuous by a rafter or other object in front. According to the account received, a colony of *C. subfurcatus* inhabited the verandah of a house in the island of Pinang. "They began with a pair, and now compose a harmonious family of about 16 or 18. The nests are fastened to the beam much in the same way as the nest of the Swallow" (*Hirundo urbica*?), "but their nidificationary habits differ from those of the latter birds by their running two, three, or more nests into one. There were about six or eight birds in the specimen of a nest herewith sent, which had three apertures. They seem to keep a regular watch at night, for on the least noise the sentinel pipes a little and is then followed by all the rest. They lay two eggs, and are not migratory,—at least my friends are not, for they have been domiciled upwards of a year where they now are."

The nest received is a beautiful fabric in its way, remarkably light and compact; being composed of feathers and other light substances firmly bound together by a good deal of the saliva-like gluten. Several shed primaries and other feathers of the birds themselves, doubtless cast within the nest, are thus fastened in to add to the lining. The only aperture visible, now that the nest has been cut away from its place of attachment, is a somewhat prolonged entrance at one extremity; and there appear to be but two depressions adapted for the reception of eggs, which renders it probable that several of its inhabitants were the young of a former brood—or perhaps broods. The total length of the interior is 12 in., by nearly 5 in. where broadest; and this capacity would indicate that it is intended as much for a habitation for a number of the birds, as for the ordinary purpose of incubation. Procuring some nests of *C. affinis* for comparison, the size of these also indicates the fact that they are similarly inhabited; but it would appear that there is no convenience in them for more than one pair of birds to incubate. They consist of a much thicker and heavier mass of material than the nest of *C. subfurcatus*; but where two are built in contact, the wall of separation is thin, though we suspect it will be always found

intact and completely separative. During the night *C. affinis* is equally vigilant with its Malayan representative. The latter would appear to be the common house Swift of the Malayan peninsula, taking the place of *C. affinis* of India; while *C. vittatus* would seem to be exclusively a mountain species, which is common at Pinang, and which Capt. Hutton has obtained from the Tyne range of mountains near Simla; and *C. leuconyx* may be the representative of the last on the mountains of S. India.

No. 420. *ACANTHYLIS LEUCOPYGIALIS*, nobis. Size of *A. sylvatica*, Tickell, *J. A. S.* XV, 284; but wholly deep black with a faint gloss of blue, except the upper tail-coverts which are greyish-white and black-shafted: tail almost square, i. e. the barbed portion of the feathers; their spinous tips well developed, those of the middle feathers protruding  $\frac{3}{4}$  in. Length of a male  $4\frac{3}{4}$  in., by  $10\frac{3}{4}$  in. in alar expanse; wing  $4\frac{3}{4}$  in.; and tail to end of spines  $1\frac{1}{2}$  in.

From Pinang; where not a common species, two or three of them appearing now and then about the hill on the island, their rapid flight rendering them difficult to shoot like the rest of the genus. The large Malayan, Nilgiri, and Ceylon species (*A. gigantea*) was observed on the same occasion: but our informant was unable to procure a specimen from the extreme velocity of its flight, which produced a loud rustling or rushing sound through the air.

*COLLOCALIA*———? (No. 428, *H.*, *Catal.*, p. 315). Several specimens of a *Collocalia* from the Navigators' Islands differ only from the Indian and Malayan *C. brevirostris*, (McClelland, v. *nidifica*, Gray), in being rather blacker, with a dingy whitish band across the rump, seen obscurely in some Indian specimens but not in others; though never so distinct or nearly so as in the Polynesian race. The latter is much too large and too dull-coloured to correspond with Mr. G. R. Gray's figure of his *C. troglodytes*, from the Malayan peninsula. That a *Collocalia* inhabits the S. Seas is, we believe, not generally known; and *C. francica*, (Gmelin), is another true species of this well marked generic form inhabiting the Mauritius, Madagascar, and probably all suitable parts of the E. Coast of Africa. Some few Indian specimens of *C. brevirostris* have the tarsi more or less feathered, as in *Cypselus* (versus).

No. 469. *CISSA PUELLA*, nobis. Size and structure of *C. VENATORIVS*, the outermost and penultimate tail-feathers shorter than in that species. Entire head, neck, and breast, with the outer webs of the primaries, secondaries, and tertiaries, bright bay or ferruginous-brown: rest of the plumage beautiful deep blue of different shades, except the tips of all the tail-feathers which are white bordered above with black, the middle pair with merely a trace of this: inner webs of the primaries and secondaries black, empurpled except on the primaries: anterior half of the wing deep indigo-blue; the back, tail except the tips, and a band across the breast, smalt blue: lower-parts dull bluish-grey. Such are the colours of what is evidently a bird in its first plumage. The beak looks as if it would probably have become deep coral-red; and the feet are pale, with dusky claws. Bill to gape  $1\frac{9}{16}$  in.; wing  $6\frac{1}{4}$  in.; middle tail-feathers 8 in., the outermost  $2\frac{1}{2}$  in., and the rest evenly graduating.

This beautiful species inhabits Ceylon.

No. 528. *PARADOXORNIS* (*HETEROMORPHA*?) *CANICEPS*, nobis. Length about 6 in., of wing  $3\frac{1}{2}$  in., and tail 3 in., its outermost feather  $\frac{1}{2}$  in. less: bill to forehead  $\frac{1}{2}$  in.; and tarse nearly 1 in. Colour rufescent-brown above, white below; the head pure grey, with a black superciliary line commencing from the nostril, and also a black chin. Bill yellow; the legs plumbeous, with conspicuously pale claws. Intermediate in form of beak to the nearly affined divisions *Paradoxornis* and *Heteromorpha*.

Procured at Darjiling.

No. 541. *PARUS RUFONUCHALIS*, nobis. Length  $5\frac{1}{2}$  in., of wing 3 in., and tail  $2\frac{1}{2}$  in.: bill to forehead  $\frac{1}{2}$  in., and tarse  $\frac{3}{4}$  in. Colour grey, with a fulvous tinge on the back and belly; nape-spot, axillaries, and lower tail-coverts, ferruginous: crown, throat and breast, black, the coronal feathers elongated to  $\frac{7}{8}$  in.: ear-coverts and sides of the neck pure white: bill black; and feet plumbeous.

The specimen described (a male) was procured by Capt. Hutton from the range beyond Simla, near the snow line.

No. 659. *CARPODACUS GRANDIS*, nobis. A typical species, distinguished by its comparatively very large size. The male is fine red, as usual, but we have only the female to describe from. Length 7 in., of wing  $3\frac{1}{2}$  in., and tail  $2\frac{1}{2}$  in.; bill to gape  $\frac{5}{8}$  in., and tarse  $\frac{3}{4}$  in. Dull

hair-brown above, the feathers centred with blackish-brown; below pale, with a median dusky streak to each feather.

From the same vicinity as the last.

No. 708. *EMBERIZA ALBIDA*, nobis. Size and structure precisely as in *E. citrinella*; and colour much the same, except that the yellow is replaced by white, and the ferruginous hue seen more or less in *E. citrinella* as a line on each side of the throat and also on the breast and flanks, is much more developed on the throat, sides of the neck, and around and posterior to the eye. Length about 6 in., of wing  $3\frac{1}{2}$  in., and outermost tail-feather  $3\frac{1}{2}$  in.

From the same vicinity as the last; and the only perfectly typical Bunting we have seen from any part of India.

No. 709. *EUSPIZA SIMILLIMA*, nobis: *Emberiza melanocephala* of India, auctororum; *Tanagra rudis*, (*Mus. Carls.*), Latham,—the female? Differs from *Eu. melanocephala* (vera) in its much smaller size; the closed wing measuring  $3\frac{1}{2}$  in. instead of 4 in., and the rest in proportion. Common in S. India.

No. 712. *EU. FLAVOGULARIS*, nobis: *Emberiza aureola* of India, auctororum. Differs from *Eu. aureola* of Siberia in having no black on the chin and throat, in the well defined yellow supercilium, and in having the ear-coverts intermixed with yellow or grey. Common in the countries bordering the Bay of Bengal to the eastward, as low as the Tenasserim provinces, and also met with in Asám and along the S. E. Himalaya.

*EU. HUTTONI*, nobis: *Emberiza Buchanani* apud nos, *J. A. S.* XVI, 780.\* Nearly affined to *Eu. hortulana*, but differing in colour, having the scapularies, fore-part of wing, and margins of the coverts and tertiaries, of the same pale rufous buff as the entire under-parts from the breast inclusive, which is similar to that of the abdominal region only of *Eu. hortulana*. Head, neck, throat, and interscapularies greyish without marks, but traces of striation on the lower part of the back. Orbital feathers whitish. Bill and feet pale. Inhabits Afghanistan.

No. 727. *ACCENTOR ATROGULARIS*, Hutton. Closely affined to *A. strophiatius*, but the throat black, divided from the ear-coverts by a pale line proceeding from the corner of the lower mandible, and this with the entire supercilium and the breast, of an uniform light rufes-

\* *E. Buchanani*, nobis, = *Eu. hortulana*, (L).

cent-sandy hue. General colour brown above, the feathers centred dusky, more rufescent on the back, greyer on the nape, rump and upper tail-coverts: crown darker; a broad upper superciliary line, with the ear-coverts and throat, dusky-black: belly whitish; the flanks streaked with dusky: wing-coverts slightly tipped albescent, forming slight cross-bands. Beak dusky, yellowish-horny towards gape; and feet pale. Length about 6 in., of wing  $2\frac{7}{8}$  in., and tail  $2\frac{1}{2}$  in.; bill to gape  $\frac{1}{8}$  in., and tarse  $\frac{3}{4}$  in.

The specimen (a male) was procured by Capt. Hutton from the range beyond Simla, near the snow line. Together with *A. strophiatius*, and an undescribed black-headed species we have also seen from the N. W. Himalaya, it would seem to be nearly affined to the very rare European *A. montanellus*, which it is probable belongs properly to the high mountains of W. Asia.

No. 800. *DRYMOICA ROBUSTA*, nobis. Differs from *Dr. sylvatica* of the Nilgiris in its darker shade of colour above, and larger and stronger bill and legs, which last appear to have been of a deep reddish-brown colour: the flanks and sides of the breast are duskyish.\*

Genus *THAMNOCATAPHUS*, Tickell. Form and aspect of *Lanius*, with exactly the beak of *Laniarius*, Vieillot, but proportionally larger, and the stouter tarse of *Telephonus* but more lengthened. Wings short and much rounded, as in the former; having the 3rd to the 7th primaries even and longest. Tail moderately long and even, with the exception of the outermost feather which is a little shorter. The plumage, also, has the soft loose character of that of *Laniarius*, contrasting in this respect with *Lanius*.

No. 866. *TH. PICATUS*, Tickell. Length about 9 in., of wing  $3\frac{1}{2}$  in., and tail the same, its outermost feather but  $\frac{1}{2}$  in. shorter; bill to gape  $1\frac{1}{8}$  in.; and tarse  $1\frac{1}{2}$  in.; vertical depth of bill  $\frac{3}{8}$ , its terminal hook and notch but slightly developed. Colour dull greyish-black above, deeper on the crown, and blackest on the lores and ear-coverts: a white line on the wing, formed by the tips of the second row of coverts and continued along the margin of the two of the first row of

\* Since the catalogue was printed, we have ascertained *Dr. inornata* (No. 804) to be merely the worn and abraded plumage of *Dr. macroura*, (Franklin), vel *fusc.* (Hodgson) No. 805, and we much doubt if *Dr. Jerdoni* (No. 803) be more than an occasional variety. *Dr. inornata* is the oldest admissible name.



coverts: lower-parts uniform rufescent-white, tinged with ferruginous on the flanks and lower tail-coverts. Bill black: and the legs apparently have been plumbeous.

From the vicinity of Darjiling. Capt. Tickell refers a second species to this genus, which is *Gampsorhynchus rufulus*, nobis (No. 865), and the affinity of which to the Shrikes we immediately recognised on seeing *Th. picatus*, though not a sufficient approximation of it to the latter to warrant (as we conceive) their being arranged together in the same minimum division. *Gampsorhynchus* has a weaker and less compressed beak, the upper mandible of which is however more hooked at its extremity; and the gape is furnished with very conspicuous long and stout vibrissæ, whereas those of *Thamnocataphus* are small and inconspicuous. There are besides various other differences.

No. 1007. *ERYTHROSTERNA FUSILLA*, nobis. Differs from the Himalayan *E. acornatus*, (Hodgson), in having the upper tail-coverts and margins of the tail-feathers constantly of a rufous-brown colour instead of pure sahy. The dimensions assigned to *E. acornatus* in XVI, 127, are those of the present species; viz. Length  $4\frac{3}{8}$  in., by  $6\frac{1}{2}$  in. expanse; wing  $2\frac{1}{2}$  in.; tail  $1\frac{1}{2}$  in.; bill to gape  $\frac{1}{2}$  in.; tarse the same. Colour grey-brown above, with a rufescent-tawney tinge on the rump, deepening on the upper tail-coverts and margins of the rectrices; there is also a rufous tinge about the lores; lower-parts white, pure on the throat, belly and under tail-coverts, tinged with grey on the breast and flanks. The axillaries also are pure white; and the greater wing-coverts are tipped with whitish, forming a slender cross-band. Bill black; and legs dark-coloured. Sexes alike.

This little unassuming bird is common upon trees about the villages of Central India, and makes its appearance soon after quitting the alluvial soil of the Lower Ganges to the westward; but we have never met with it upon the alluvium. In habits, as in structure, it much resembles *E. leucura*, which last has all the manners of the true Robins, and certainly is not more of a Flycatcher than the common British Redstart. The name *Erythrosterna*, by no means felicitous, was applied by the Prince of Canino to the *Muscicapa parva*, auct., of S. Europe; from which our Indian *E. leucura* would seem only to differ in having the ferruginous colouring which the males assume in spring confined to the chin and throat; instead of spreading down the breast as in *Ery-*

*thaca rubecula*. *E. erythaca*, nobis, J. A. S. XVI, 126, is again closely affined, but well distinguished. Identical in structure, but without the white on the tail, though otherwise similar in general colouring, and also of a smaller size, we have them the Himalayan *E. acornaeus*, of which we have now seen numerous specimens all quite similar; and the present little bird of Central India, which we formerly supposed to be identical with the last, until we found the distinguishing characters of each to be constant.

No. 1020. *CYORNIS MAGNIROSTRIS*, nobis. The same Darjiling collection which yielded the fragments of a *Batrachostomus* contained also the female of a species of *Cyornis* quite different from any previously examined. It resembles the female of *C. rubeculoides*, but is larger, with a proportionally larger and more robust bill, a very conspicuous ring of rufescent feathers around the eye, and very pale or whitish legs and claws. Length about 6 in., of wing 3 in., and tail  $2\frac{1}{2}$  in.; bill to gape  $\frac{7}{8}$  in.; and tarse  $\frac{3}{4}$  in. Colour brown above, darker and less tinged with tawney than the female of *C. rubeculoides*: wings and tail inclining to ferruginous: lower-parts bright ferruginous, paler on the throat, pure white on the belly and lower tail-coverts, and the flanks brown. Bill dusky. This bird is certainly neither the female of *C. unicolor*, nobis, also a Sikim species; nor that of *C. pallipes*, (Jerdon), of S. India.

No. 1065. *MUSCISAXICOLA*——? Length  $7\frac{1}{2}$  in., of wing 4 in., and tail 3 in., its outermost feather  $\frac{1}{2}$  in. less; bill to gape 1 in.; and tarse the same. Colour brown above, paler below; supercilium and throat white, the latter speckled over with dusky tips to the feathers: white centres to the pectoral feathers more or less developed: base of the secondaries and some of the primaries ferruginous, bordered with a blackish band beyond, and then again rufescent. Bill dusky, and feet brown. From Chili.

No. 1199. *HIRUNDO HYPERYTHRA*, Layard. Resembles *H. daurica*, but has the entire under-parts (inclusive of the ear-coverts) of the same deep ferruginous hue as the rump, which is deeper than that of *H. daurica*: the mesial streaks of the feathers of the lower parts being less developed. Accordingly, this species bears exactly the same relationship to *H. daurica*, which *H. cahirica* does to *H. rustica*, and has the same claim for separation.

It appears to be peculiar to the island of Ceylon, where Mr. Layard informs us that "it builds in the houses of Newera Eliya, and does not migrate." A remarkable contrast to the habits of *H. daurica*; while it curiously resembles in its stationary abode the *H. cahirica*."

No. 1834. *ALCIPPE NIGRIFRONS*, nobis. Closely affined to *A. atriceps*, (Jerdon), from which it differs in not having the whole crown black, but only the forehead continued as a line backward over each eye, and the ear-coverts. The tail also is darker, and distinctly rayed with dusky-black. General hue fulvous-brown above, and on the flanks and lower tail-coverts: rest of the under-parts pure white, the axillaries tinged with rufescent. Wing  $2\frac{1}{4}$  in.

Inhabits Ceylon.

Genus *DRYMOCATAPHUS*, nobis. Type *Brachypteryx nigrocapitata*, Eyton.

No. 1835. *DR. FUSCOCAPILLUS*, nobis. Like *Dr. nigrocapitata*, but the supercilia, uniform with the lores, ear-coverts, sides of neck, throat, and entire under-parts, pale ferruginous-brown, a little deeper on the breast: coronal feathers dark brown margined with dusky-black, and pale-shafted: rest of the upper-parts uniform greyish olive-brown, the primaries margined paler, and the extreme tips of the tail-feathers rufescent. Bill pale, the upper mandible dusky: and feet pale. Length about  $6\frac{1}{2}$  in., the wing  $2\frac{7}{8}$  in., and tail  $2\frac{1}{2}$  in.: bill to gape  $\frac{1}{8}$  in.; and tarse 1 in.

Inhabits Ceylon.

No. 1079. *ACROCEPHALUS DUMETORUM*, nobis: SYN. *Acr. montana* of India, auctorum. "*Calamoherpe montana* of India," writes Mr. Strickland, "is not Horsfield's *montana*, in which the wing is 2 in. long, graduated; the 5th quill longest."

No. 1836. *LEUCOCERCA COMPRESSIROSTRIS*, nobis. Like *L. albofrontata*, but with the bill much more compressed. Perhaps a variety only. From Ceylon.

No. 1219, *C. DICRURUS MACROCERCUS*, var. The Cinghalese representative of this species appears to be invariably much smaller than the race of all India, adults having the wing but 5 to  $5\frac{1}{2}$  in. (instead of 6 in.), and the rest in proportion. *D. longicaudatus* of Ceylon differs in no respect from the common Indian bird; but *D. carulescens* of India is replaced in Ceylon by the nearly affined *D. leucopygialis*: and a very distinct species exists in the same island, the *D. edoliformis*, which is

in fact an *Edolius* without the racket tail, its tail quite resembling that of *D. macrocercus*.

No. 1248. *HYPSSIPETES CONCOLOR*, nobis. Resembles *H. psaroides* and *H. nilgiriensis*; but is altogether blacker, the black of the crown forming thus no contrast with that of the rest of the upper-parts: lower-parts and rump dusky-cinereous, and slight edgings of the same to the alars and caudals: upper tail-coverts black.

Inhabits the Tenasserim provinces.

No. 1397. *PTILINOPUS*——? A beautiful species from the Navigators' Islands. Predominant hue of the male a pale canary-yellow, or yellowish-white (that of a *Mealy* Canary) with a broad band of deep lake-red crossing the back and shoulders of the wings; cap of the same lake-red, also the lower tail-coverts, and the medial portion of the pectoral feathers, which last have forked or divergent broad white tips: below, the breast is tinged with orpiment-yellow; and the lower portion of the back and edges of the tertiaries are bright yellowish-green: outer webs and tips of the secondaries and primaries deep green, the secondaries having a very narrow white margin: wing-coverts, tertiaries, and tail greyish-white, more or less margined with the yellowish-green hue of the lower back. Wing 5 in.; tail 3 in. In the female the predominant hue is deep green, a little bronzed on the wings; the tertiaries are slightly edged with yellow; the vent is yellow; crown and lower tail-coverts as in the male, lake-red, but the latter mingled with the yellow of the vent; the sides and back of the neck are tinged greyish, with an obscure dull fulvescent band in place of the bright red dorsal band of the male; and the breast is green, with white tips to the feathers. Outermost primary sinuated as usual in this genus.

No. 1400. *CARPOPHAGA IANTHINA*? *Columba ianthina* (?), Temminck. A typical species, with the base of the upper mandible tumid. Head, neck and breast uniform pale and slightly vinaceous grey, with a slight white ring surrounding the base of the bill; abdominal region pale dull vinaceous, passing to deep ferruginous on the lower tail-coverts: rest of the upper-parts deep emerald green mingled with steel-blue, which last predominates on the primaries and tail. Wing 10 in.; tail 6½ in. Received from Java.

No. 1402. *C. FUSILLA*, nobis. Like *C. sylvatica* (vel *ænes* of India), but much smaller, and the nape very rufescent. Length of wing 8½ in.; of tail 5½ in. Nilgiris.

No. 1407. C. (?)—? General aspect of typical *Carpophaga*, but the wings and tail comparatively very short, and the colouring much as in *Chalcophaps*. Head and throat dull vinaceous-brown, deepest on the occiput, paler about the forehead, and passing to deep bay or reddish-ferruginous on the breast, again paling and passing to dingy isabelline on the vent and lower tail-coverts: nape pure ashy: mantle and wings deep emerald-green, bronzed on the middle of the back, and passing to fine garnet-red on the upper tail-coverts: tail glossed with the same, and blackish with the terminal fourth pale grey. Length of wing  $7\frac{1}{2}$  in.; and tail  $4\frac{1}{2}$  in. This very beautiful species was obtained on an islet off the coast of Waigou.

No. 1413. *PALUMBUS TORQUATUS*, Asiatic or Himalayan variety. Only differs from the European race in having the neck-patch constantly of a pale buff colour instead of white, and generally much less developed, being often nearly obsolete. Common in the N. W. Himalaya.

No. 1427. *GEOPHELIA ALBIVENTRIS*, nobis; *Columba Maugei* (?), Temminck. This species differs from *G. tranquilla* of Australia in having the barring of the breast carried much further down, and extending across the breast (which is not the case with *G. striata* of the Malay countries), and the abdomen and lower tail-coverts are pure white, without any rufescent tinge. From Timor, whence not unfrequently brought alive to Calcutta, together with *Turtur bitorquatus*, *Chalcophaps chrysocolora* (the Australian species), and numbers of *Cacatus sulphureus*. Though named *albiventris* in the Catalogue, we have now reason to suppose it to be *G. Maugei*.

Nos. 1467 to 1470. *EUPLOCOMUS*. There are four well marked races of *Kallij* Pheasants severally inhabiting different parts of the Himalaya, Asám, and the Burmese countries; and they seem to interbreed freely together in the wild state, producing every gradation of intermediate variety, wherever either of them comes in contact with another in the same region. This is most remarkably shewn in *Eu. lineatus* (No. 1467) of Tenasserim, &c., and *Eu. Horsfieldi* (No. 1468) of Asám and Sylhet, the intermediate Arakan race shewing every possible gradation from one to the other: and the Nipalese *Phasianus leucomelanos*, Latham, intermediately placed to *Eu. albocristatus* (No. 1470) of the N. W. Himalaya and *Eu. melanotus* (No. 1469) of the Sikim ranges, is in like manner intermediate; the male having a black

crest, and the quantity of white bordering the rump-feathers of *Eu. albocristatus* much reduced. The male *Eu. melanotus* has a thin black crest, and no trace of white on the rump, and its tail is also longer than in the others; but in other respects it is quite similar to *Eu. albocristatus* of the N. W.; and the females of all are alike, except that the hen *Eu. lineatus* has the pectoral feathers white-centred to a greater or less extent.

On the other hand, it may be remarked that a pair of hybrids raised from the male *Gallus Sonneratii* and a picked common hen engendered very freely, and many eggs were laid; but none of these would hatch, although other eggs placed with them in the same nest produced chicken, as usual; numerous other eggs were also obtained from the female hybrid trodden by a common domestic cock, and from common hens trodden by the male hybrid; but all attempts to hatch these were equally unsuccessful.\* We now expect to raise hybrids from the male *Gallus Stanleyi* (vel *Lafayettei*) and a prolific half-bred jungle-hen from Arakan, apparently the produce of a domestic hen by a wild *G. ferrugineus* (v. *bankivus*); and hope to be able to follow up the experiment as with *G. Sonneratii*. That all our diversified domestic fowls are derived from *G. ferrugineus* is indicated by the *crow* of any domestic cock and by all the *language* of the poultry-yard, which are essentially similar to the notes of the wild bird; whereas the voice, whether of *G. Sonneratii* or of *G. Stanleyi*, in every note they utter, is exceedingly dissimilar from the voice of *G. ferrugineus* wild or tame, and equally unlike one from the other. Yet the cocks recognise and acknowledge each other's widely different *crows*, and fight as eagerly together as with their own kind.†

\* Yet we have seen ‡ bred fowls (i. e. † Pheasant) in the London Zoological Gardens; an intermixture in this case of different genera (as now recognised), instead of different species of the same genus.

† The crow of *G. Stanleyi* is a sharp dissyllabic sound, in which Cinghalese sportsmen fancy they hear the words 'John Joyce,' pronounced very sharply and in a peculiar key. (Layard.) That of *G. Sonneratii* may be imitated, but scarcely expressed in writing,—a sort of *charar-charácha*.

Here it may be remarked that a friend lately succeeded in obtaining a hybrid chick between the male *Pavo muticus* and female *P. cristatus*; but unfortunately it did not live many days, and it is now mounted in the Society's Museum.

Nos. 1510 to 1512. *ARBORICOLA*, Hodgson. There are three distinct races or species of this genus which require discrimination.

No. 1510. *A. TORQUEOLA*; *Perdix torqueola*, Valenciennes: *P. mesopodia*, Temminck; *P. olivacea*, Gray. The common Himalayan species, from Simla to Darjiling; with the crown and ear-coverts of the male ferrugineous, passing down the sides of the neck; lores, supercilia, and throat black, the lateral and lower feathers of the last white-margined; a broad and *defined* white torque or gorget above the breast, and sometimes (but not always) a small white streak from the base of the lower mandible. Females have the torque ferruginous, and the throat less deep ferruginous spotted with black more or less; the crown and ear-coverts dusky olive-brown, and a pale rufescent supercilium speckled with black: the black bars and spots are also more developed on the upper-parts generally; and the ferruginous torque has never a black border. This is the only race we have seen from the N. W. Himalaya; and at Darjiling we are informed that it inhabits a loftier range of elevation than the next.

No. 1511. *A. RUFGULARIS*, nobis. Rather smaller, on the average; throat and front and sides of neck of the male deep ferruginous, with small black specks on the throat and a *black margin* to the ferruginous more or less developed, separating it from the pure ash-colour of the breast; an ill-defined white streak with black specks on each side of the throat, and similar but more rufescent supercilia. The bars on the upper-parts are generally quite obsolete. In the females these are well developed; and unless the throat may be of a deeper ferruginous, there seems to be no difference between this sex and the female of *A. torqueola*. The present race would appear to be common in the vicinity of Darjiling.

No. 1512. *A. ATROGULARIS*, nobis. Breast and flanks of the male pure ashy without any rufous, but a few small white spots on the flanks; abdominal region pure white; crown of the same olive-green as the back, passing to ashy on the forehead; supercilia black margined above with white, and lores black bordered below with a broad white streak from the base of the lower mandible; chin also white in some, but in general the chin and throat are deep black, bordered below by an *undefined* white gorget, and the upper-part of the breast has large black drops below the white gorget. The upper-parts are more dis-

tinctly barred in this sex than in either of the other races; and there are no white medial streaks on the scapularies. The female is at once known by her black throat, passing into rufous with black spots below; middle of front of neck unspotted rufous; breast ashy, with a little rufous on the flanks; and the upper-parts unbarred, instead of having broad black bars as in this sex of the other races. *A. atrogularis* is common in Asám, Sylhet, and Arakan, from which provinces we have seen many dozens alive at different times, and always true to the distinctive characters here indicated. In the Tenasserim provinces, this race seems to be replaced by the affined *Rollulus* (?) *ocellatus*; and about Pinang the representative is *A.* (?) *Charltoni*, (Eyton), though *R.* (?) *ocellatus* likewise inhabits the same latitude in the Malayan peninsula, but we have never seen either in Malacca collections.

No. 1528. TURNIX——? A small extra-Indian species, resembling the hinder figure of Dr. A. Smith's plate of *T. lipurana* of S. Africa, except that the bill and feet are yellow, and the forehead, supercilia, cheeks, and breast are bright ferruginous, extending laterally upon the flanks, which have transverse black spots bordered with white; abdominal region white, passing to pale rufous on the lower tail-coverts. Upper-parts with alternately black and deep ferruginous narrow cross-bars, and the feathers more or less edged with yellowish-white: primaries plain brown, the three outer with a pale yellowish margin; and the coverts are speckled with small white spots on a ferruginous ground variegated with black. Bill slender. Wing  $3\frac{1}{4}$  in. Tarse  $\frac{3}{4}$  in. Habitat unknown. Probably China? Or Philippines?

No. 1659. PORPHYRIO CHLORONOTUS, nobis. Similar to *P. ALLENI* figured in Mr. G. R. Gray's 'Illustrated Genera of Birds,' but very much smaller, the wing but  $5\frac{3}{8}$  in., bill to gape  $1\frac{1}{2}$  in., and tarse 2 in. Habitat unknown. For dimensions of *P. Alleni*, vide *Ann. Mag. Nat. Hist.* X, 204.

No. 1673. RALLUS INDICUS, nobis. Resembles *R. aquaticus*, but averages a rather larger size, having the wing 5 to  $5\frac{1}{4}$  in., and the bill is constantly more robust. Of many dozens of specimens, we have never once seen the pure ashy hue of the under-parts so common in *R. aquaticus*, there being always much intermixture of brown. Common in L. Bengal, and in India generally.

No. 1764. SARCIDIORNIS (?) LEUCOPTERUS, nobis. This is a very



fine new Duck, with broader and more depressed bill than in *S. melanotus*, and no knob in the only specimen as yet examined. The tarsi also are shorter, the toes larger, and the claws much larger than in *S. melanotus*. General colour black above and below, a little glossy on the back. Head and neck white, with black feathers interspersed, forming more elongated spots than in *S. melanotus*. Anterior half of the wing white externally, followed by a black speculum; the primaries and tertiaries black, secondaries dark ash-grey, and the proximate tertiary having about half of its outer web white, longitudinally and obliquely separated, and bordered with black exteriorly. Bill yellow, with some lateral black specks, the dertrum darker; and the feet appear to have been orange. Length of wing 15 in.; of bill to gape  $2\frac{1}{2}$  in.; its uniform breadth across about  $\frac{1}{8}$  in.; tarse  $2\frac{1}{4}$  in.; and middle toe and nail  $3\frac{3}{8}$  in. From the Tenasserim provinces, where said to be not uncommon. *N. B.* Though approaching *Sarcidiornis* in plumage, and especially in its spotted head and neck, this bird should perhaps rather range nearer to *Anas* proper.

No. 1786. FULIGULA——? This Cape Pochard was described as *F. mariloides* in *J. A. S.* XII, 180, but it seems to be another closely allied species; if new, *F. obscura*, nobis.

No. 1741. PELICANUS JAVANICUS (?), Horsfield. No. 1742. P. PHILIPPENSIS, Gmelin, described *Ann. Mag. N. H.* XIV, 122. These two species of Pelican are common throughout S. E. Asia, and its islands, and we believe are here correctly identified. The first closely resembles *P. onocrotalus*, but has never the full and copious pendent occipital crest of slender feathers, about 5 in. long, which distinguishes *P. onocrotalus* at least in the breeding season; the head and neck plumage being of quite a different character, not silky and fur-like and the feathers undistinguishable apart as in *P. onocrotalus*, but open, flimsy, and downy, and curving round upward towards the occiput,—characters which are more strikingly developed in *P. philippensis*.

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*Sketch of the Recorded Revenues of the states beyond the Sutlej,  
about 1750 to 1800, by Major ANDERSON, C. B.*

At a period when so much attention is being bestowed upon the newly acquired territories of the Punjab and Peshawur, a sketch of their anciently estimated revenue may not prove devoid of interest; these, are given in totals; the amount being that demandable by the state, as the claims on the various districts; for what would now be simply denominated land revenue, in those days, the greater portion consisted in the share of the grand grain crop; though no doubt, many minor taxes and huwaluhs are also included, as the proportion of the minor or secondary crops, with shop, poll, and cattle taxes.

In the demands on the towns are also included the various excise and transit duties.

The total contains the various Jaageers granted to state officers and servants; a mode in which a very large portion of the armies of the Government was paid; these Jaageers might probably amount to  $\frac{4}{5}$  of the whole, leaving  $\frac{1}{5}$  for the private purse of the emperor. On the other hand these totals are not the whole extracted from the people; at least  $\frac{1}{2}$  more might be added, for local impositions, expences of collections, dues to village and district officers, &c.

The amounts were first taken from the Meezan ol Momalek of Moezallah Mohmunde, of Peeshawur; written for Wulee Khan Wuzeer to Ahmud Shah Dooranee.

The various items of Kabul and Peeshawur, within a trifle, give the stated totals; as from his position the writer must have had opportunity to correctly ascertain these amounts.

But when he proceeded to the more distant places of Lahoor and Scinde, either from original want of information, or from errors of transcription, the items and totals can in no respect be made to correspond.

Recourse has therefore been taken to the Chuhar Gulshun; and as of it, the totals correspond with the totals of the Meezan; the details also of the first work were accepted as correct and are used for Lahore, Moltan and Tutuh. The rupee in quantity of silver may be taken as equal to that of the present Company's rupee.

Whether the countries have improved, since these periods, is a question; but I should be inclined to think they have retrograded.

Kabul and all the trans-Indus states have deteriorated ; Cashmeer was ever overrated. The removal of the grand governments from Delhi as a centre, with the alterations of the lines of trade, must all have operated on those quarters distant from the sea and from the capital, hence it may be questioned if these amounts of revenue are at the present moment exceeded.

What may be effected under an enlightened Government and a continuance of peace, remains to be seen.

#### Revenues of the Soobuh of Kabul.

City of Kabul, ..... 10,53,597

#### Koh-damun.

Ushturgram, ..... 1,16,109

Ertalef, ..... 2,35,164

Kah-duruh, ..... 74,572

Lumghan, ..... 78,612

Bulkhak, ..... 78,642

Muhood Urakee, between Kabul and Nugruo, ..... 76,454

Sal, Oolung, near Sirchushmuh, 33,359 6,99,567

#### Lhoogurd.

Lhoogurd, ..... 2,15,721

Muedan, ..... 65,525

Huzaruh Behsood, ..... 15,000 2,96,246

Guznuen, called Nawur, ..... 93,155

Guznuen, ..... 76,425

Gurdeez, ..... 7,500 1,77,080

#### Zermol.

#### Ghoorbund.

Ghoorbund, ..... 46,279

Kahmurd, ..... 61,250

Bamean Zoohak, ..... 37,500 1,45,029

#### Punjeer or Punjsheer.

Punjeer, ..... 30,625

Nujruo, ..... 37,500

Budruo, ..... 27,500

Ulusa, ..... 15,000 1,10,625

Nungnuhar or Julalabad, ..... 75,952

|                                   |          |                  |
|-----------------------------------|----------|------------------|
| Sorkhab.                          |          |                  |
| Hukumabad.                        |          |                  |
| Chupral.                          |          |                  |
| Kashkoot.                         |          |                  |
| Konur.                            |          |                  |
| Kamuh.                            |          |                  |
| Koot Teeruh.                      |          |                  |
| Lumghanat.                        |          |                  |
| Ueeshung, .....                   | 3,01,714 |                  |
| Mundrawur, .....                  | 1,98,639 |                  |
| Eslamabad, .....                  | 65,242   |                  |
| Ulungar, .....                    | 69,647   | 6,44,242         |
| Modern Kabul.                     |          |                  |
| Begram or Peeshawur, .....        |          | 4,55,000         |
| Punjabee Afghan.                  |          |                  |
| Mohmund.                          |          |                  |
| Khuleel.                          |          |                  |
| Daoodzuee.                        |          |                  |
| Kugyanee.                         |          |                  |
| Hustghur or Hushtnugur, .....     | 3,68,525 |                  |
| Khalsuh, in various places, ..... |          | 86,481           |
| Yoosufzuee.                       |          |                  |
| Suwad, capital Mungloor, ....     | 50,000   |                  |
| ,, ,, Punjkooruh, ....            | 1,125    |                  |
| Boneer, Mundure, Lungur-koot,     | 50,000   | 1,01,125         |
| Bujoor.                           |          |                  |
| Konur, .....                      | 51,000   |                  |
| Chugan, Surue, .....              | 12,500   |                  |
| Butkee Kool or Punch ? .....      | 18,850   |                  |
| Lushkurpoor or Soor Kumur, ..     | 12,500   | 94,850           |
| Bungushat.                        |          |                  |
| Korum, .....                      | 2,09,441 |                  |
| Kohat, .....                      | 60,000   | 2,69,441         |
| Nughz or Zudran, .....            |          | 3,851            |
| Bunwan,                           |          |                  |
| Grand Total, .....                |          | <u>45,81,610</u> |

|                                                       |           |             |
|-------------------------------------------------------|-----------|-------------|
| Districts remaining to modern Kabul, ..               | 32,02,338 |             |
| „ acquired to the Punjab, .....                       | 13,79,272 |             |
| Cashmeer.                                             |           |             |
| Meraj and Kamraj, .....                               | 25,00,000 |             |
| Kishtewar, ....                                       | 1,00,000  |             |
| Tebbut, small, .....                                  | 2,00,000  |             |
| „ large.                                              |           |             |
| Buloor containing the temple of a<br>celebrated idol. |           |             |
| Pukulee, .....                                        | 1,90,800  | 29,90,800   |
| Moltan.                                               |           |             |
| Moltan, .....                                         | 31,80,683 |             |
| Debalpoor, .....                                      | 6,09,681  |             |
| Bhukur, .....                                         | 6,59,931  |             |
| Shewestan or Shewan, .....                            | 2,90,740  |             |
| Nughurabad, or Deeruh, .....                          | 6,25,594  | 53,66,530   |
| Tutuh.                                                |           |             |
| Tutuh, .....                                          | 7,99,383  |             |
| Hajeekhan rather Chachgan, .....                      | 2,01,737  |             |
| Chukurhaluh, .....                                    | 4,30,377  |             |
| Nusrpoor, .....                                       | 3,01,411  | 17,32,908   |
| The Soobuh of Lahoor.                                 |           |             |
| Buet Julundur, .....                                  | 35,94,625 |             |
| Dooabe Baree, .....                                   | 49,33,927 |             |
| „ Chunao, .....                                       | 10,66,212 |             |
| „ Jhoobut, .....                                      | 23,17,208 |             |
| „ Send Sagur, ..                                      | 35,14,996 |             |
| Dhum Mulooke, .....                                   | 3,75,518  |             |
| Kanguruh, Nugurkoot, .....                            | 6,78,121  |             |
| Chumbuh, .....                                        | 1,15,000  |             |
| Kuhloor, capital Pulashpoor, .....                    | 45,000    | 1,66,40,606 |
| Grand Total of Trans-Sutluj India, .....              |           | 3,13,12,514 |

Now thus distributed.

| Punjab,                                | English. |             |             |
|----------------------------------------|----------|-------------|-------------|
| Lahoor, ..                             | „ .....  | 1,66,40,606 |             |
| Moltan, ..                             | „ .....  | 31,80,683   |             |
| Daruhjat, ..                           | „ .....  | 6,25,594    |             |
| Debalpoor, ..                          | „ .....  | 6,09,681    |             |
| Acquired from Kabul, trans-Indus, .... |          | 13,79,272   | 2,24,35,836 |

|                                                                                              |          |           |             |
|----------------------------------------------------------------------------------------------|----------|-----------|-------------|
| Kabul Dost Mohummud, .....                                                                   |          |           | 32,02,338   |
| Cashmeer Gulab Sing,.....                                                                    |          |           | 29,90,800   |
| Scinde                                                                                       | English. |           |             |
| Tutuh,                                                                                       | „        | 17,32,908 |             |
| Bhukur,                                                                                      | „        | 6,59,931  |             |
| Shewan,                                                                                      | „        | 2,90,740  | 26,83,579   |
| Grand Total, three crores, thirteen lacs, twelve thousand, five hundred and fourteen rupees, |          |           | 3,13,12,514 |

*An Eighteenth Memoir on the Law of Storms in India, being the Cyclone of 12th to 14th October 1848 in the Bay of Bengal. By HENRY PIDDINGTON, President of Marine Courts.*

[Throughout this paper the word CYCLONE designates a Circular Storm.—H. P.]

PART I.

Between the dates above—stated a Cyclone of excessive violence which probably originated in the China Sea on the 7th\* *settled down* in the middle of the Bay of Bengal in about Lat. 17° 47'; Long. 88° 18'; and travelled up to the N. 41°, West to Point Palmiras. From this spot, and on this rhumb, it exactly crossed the track of both the outward and inward bound ships, and this at a busy season, so that much destruction of life, and loss of property took place amongst those who were ignorant, neglectful, or despisers of the Law of Storms; seven vessels having disappeared and fourteen being dismasted. But on the other hand, as will be seen in the Logs and in the Summary and Notes which follow them, we can now adduce numerous and striking examples in which ships have distinctly and unquestionably been saved from severe straining and damage, and in some instances probably from foundering, by the careful attention of their commanders to the precepts of the new

\* Of which I have little doubt. It may have come in from the Pacific Ocean; the term *settled down* will be subsequently explained.

science, so distinctly indeed that I shall at the close of this Memoir give a list of the whole of the vessels with a brief note to each, describing their management and what it should have been according to our rules, which every sailor can verify upon the chart with the Log before him. This may probably offend some few individuals at first, but I entreat them to recollect that it is only by pointing out their errors in judgment that we can enforce, and so to say, *justify* our science to the profession at large. They may be comforted too with the reflection that fifteen years ago, had I then commanded a ship, I should myself probably have been found in the list of the blunderers.

The Cyclone cannot be said to have been felt as a heavy gale beyond Kedgerie and Saugor. At Calcutta we had nothing but the outer and varying gusts of the storm circle on the 13th, 14th and 15th, and the Barometer was not below 29.70, but there was quite enough to enable me to announce correctly in the newspapers what had taken place in the Bay, and this was soon amply confirmed by the arrival of numerous dismasted vessels; and the lessons these afforded, as contrasted with those who could fairly claim credit for good management were, as will be seen not few nor unimportant.

Like the Cyclone which passed over Calcutta in June 1842, and which forms the subject of the seventh of these Memoirs (J. A. S. Vol. XI.) the opportunity was not one to be neglected, and I have spared no pains to collect every line of information which could be obtained, and I have much pleasure in thanking the Public Officers of the Marine Departments, Merchants, Commanders and Officers of ships, all of whom with the exception of two or three were most attentive to my requests, and some of them most zealous in procuring from the unwilling, the dilatory, or the diffident, copies of their logs and notes, or replies to what must, to many I dare say, have appeared my troublesome or useless queries. I have been however able to establish with confidence by the ample records of this Cyclone many points of high importance to the mariner in his approach to our dangerous river, so as to afford him at length a code of practical directions how to manage on their approach, and to corroborate much of which we had before rather inferential than direct evidence.

In the arrangement of this Memoir as in the former ones I have first given the various logs and notices, commencing with those from the eastern side of the Bay in the Andaman sea and on the eastern and

north-eastern coasts as far as Chittagong. These are followed by those of the inward bound vessels from Madras and Europe, and then by those of the ships which stood to sea from the Sand Heads. The logs of the Pilot and Light vessels are included in the Tabular statement. I have then in a Summary detailed the grounds on which the places of the centre are laid down, and the rates of travelling, and the Summary is followed by Remarks on the various phenomena which this Cyclone has so well exhibited, and which are so essential to advance our knowledge of their causes, and as warnings of these terrific meteors, and upon Diagram No. IV. which affords by contrast a very remarkable and important lesson. I have then given a brief review of the management of each ship and a statistic summary of the whole, which will be found of great interest. The concluding section is one of Practical deductions for the management of inward and outward ships at or nearing the Sand Heads, on the approach of a Cyclone, which I trust may be found useful to the careful mariner who has the interests of his country or of his owners at heart. I should not omit to state that this memoir was ready in September, but the arrangements of the Journal would not permit of its being then published. As however a Cyclone might have occurred in October when the practical directions would have been useful to the outward bound ships, I applied to the Secretary, Mr. Laidlay, for the permission of the Council to publish that part in the newspapers, which was most readily accorded. Numerous copies of it were distributed, and Government was also supplied with them for the use of the Pilot and other sea-going vessels in its service.

*Abridged Log of the BRIG TEAK (No. 2 on the Chart) Captain  
McFARLANE, from Pinang to Calcutta, Civil Time.*

The *Teak* left Pinang on the 19th Sept. 1848, but only passed the Sayer Islands on the 6th Oct. On the 8th Oct. in  $11^{\circ} 20' N.$  Long.  $96.31$  East, had moderate breezes S. E. and by midnight had a strong gale and hard gusts at S. W.

On the 29th October, strong breezes S. S. W. to south, with squalls and rain, 8 A. M. Simp. 29.94, Bar. 30.45.

10th Oct.—Wind from S. b. W. to S. S. W. and south, strong breeze, hard squalls and rain, the squalls veering to S. W. very uncomfortable sea. Noon Lat.  $15^{\circ} 13' N.$ ; Long.  $93^{\circ} 48' East$ ; A. M. Simp. 29.84. Midnight in 50 fathoms water.



11th Oct.—Running throughout to the W. N. W. from 5 to 8 and 9 knots, with wind South to 6 A. M. and then S. S. E. throughout, with heavy squalls and gusts, but moderating at times before noon, when Lat.  $15^{\circ} 19'$  North; Long.  $91^{\circ} 26'$  East; Bar. 29.65. Ther.  $81^{\circ}$  A. M. 2 P. M. Bar. had fallen to 29.60; making preparations for bad weather. Midnight strong gale and very high sea.

12th Oct.—To Noon running to the N. N. W. 6 and 8 knots. Wind S. S. E. to 3 A. M. when South and S. S. E. again at 8 A. M.; 6 A. M. furious gale, the sea a sheet of foam. At Noon Lat.  $18^{\circ} 9'$  North; Long.  $90^{\circ} 00'$  East; Bars. 8 A. M. 29.47 and 29.50; Simp. 30.20; Ther.  $81^{\circ}$  Noon Bars. 29.50 and 29.47; Simp. 30.10; Ther.  $82^{\circ}$  P. M. Gale and sea increasing and vessel ready to broach to; hove to, wind S. S. E.; 3 P. M. blowing furiously, a deluge of rain and fearful sea; 4 P. M. wind S. E.; 6 P. M. Bars. 29.40 and 29.45; Simp. 30.05; Ther.  $62^{\circ}$ . At 8 P. M. Bar. 29.58 and 29.50; Simp. 30.16; Ther.  $82^{\circ}$ . At 10 P. M. Bars. 29.64, 29.60; Simp. 30.20; Ther.  $82^{\circ}$ . Midnight clearing a little.

13th Oct.—Lying to. To noon wind S. E. strong gale and high breaking sea, weather clearing now and then; at 6 A. M. a bank of clouds to the N. W. 6 A. M. Bars. 29.65 and 29.52; Simp. 30.26; Ther.  $81\frac{1}{2}^{\circ}$ . Noon 29.65 and 29.63; Simp. 30.25; Ther.  $82^{\circ}$ . Lat.  $18^{\circ} 37'$  N.; Long.  $89. 17. E.$ ; P. M. Wind as before; very high and confused seas running in Pyramids and constantly breaking; besides a very high sea from the S. E. another equally high from the S. W.,\* had all the appearances of what is said of the sea in and after a hurricane or Typhoon. At 7-30 P. M. finding the weather had cleared, though still blowing a hard gale in unequal gusts, borne up W. N. W. and by 8 got sail fairly set. To 6 P. M. Bars. 29.60 and 29.60; Simp. 30.25; Ther.  $82^{\circ}$ . At 10 P. M. 29.68 and 29.66; Simp. 30.30; Ther.  $83^{\circ}$ . Midnight strong gale hard gusts and overcast sky, sea very confused.

14th Oct.—A. M. wind S. S. E. 4 A. M. cleared up. 8 A. M. Bars. 29.70 and 29.70; Simp. 30.30; Ther.  $83^{\circ}$ . Noon Bars. 29.65 and 29.65; Simp. 30.20; Ther.  $83^{\circ}$ ; Noon Lat. Obs.  $19^{\circ} 18'$  N.; Long. Chr.  $67^{\circ} 51'$  East.

*Abridged Log of the SCHOONER JOVEN CORINNA (No. 1 on the Chart) Capt. C. S. RUNDLE from Calcutta to Moulmein. Civil Time.*

The *Joven Corinna* was at Noon 8th Oct. in Lat.  $16^{\circ} 16'$  N.; Long.  $91^{\circ} 23'$  East; with a light breeze from the East; Bar. 29.74; Simp.

\* The vessel was now, as will be seen on Diagram, No. II. just without the circle, and in that part of it where the monsoon is probably forcing its way beneath the lifted part of the Cyclone. And to this we may attribute the double sea so clearly described here. The bank of clouds was undoubtedly the body of the Cyclone.

29.14; Ther. 86°. At 6 p. m. Bar. 29.72; Simp. 29.10; Ther. 85. Wind E. N. E. to midnight; vessel standing to the S. E. with a heavy head sea.

9th Oct.—Steady E. N. E. winds; increasing at 8 a. m. with cumuli; Bar. 29.71; Simp. 29.16; Ther. 85°; heavy swell from E. S. E. made preparations for bad weather. Noon strong gales East; Lat. 14° 47'; Long. 91° 54' East; Bar. 29.65; Simp. 29.10; Ther. 85. Cumuli throughout; 8 p. m. to midnight moderate; Bar. 29.69; Simp. 29.38; Ther. 85°.

10th Oct.—4 a. m. nearly calm; by 8 steady S. S. E. winds, cloudy, Cumulo-stratus and Nimbi. Noon steady wind South; Bar. 4 a. m. 29.70; Noon 29.67; Simp. 29.10 and 29.05; Ther. 85° and 86°; Lat. 15.37; Long. 92° 29' East; 2 p. m. wind in a strong squall from arched Nimbi shifted to S. W.; by 3, it is marked W. S. W. strong gales and fierce squalls with heavy rain from arched Nimbi with a very high and irregular swell and sea on. At 6 wind S. W. At 8 Bar. 29.66; Simp. 29.12; Ther. 84°, moderating a little, but at midnight, as before. Clouds marked as dense stratus and arched Nimbi.

11th October.—A. m. wind S. S. W. fierce gale and fearful squalls, but moderating to noon when fresh winds and cloudy; 5 a. m. wind S. b. W. At 7 a. m. Bar. 29.72; Simp. 29.70; Ther. 84°. Noon Lat. Obs. 15° 21' N.; Long. 94° 26'; Bar. 29.70; Simp. 29.17; Ther 4°. p. m. wind South, 5 p. m. S. b. E.. 6 S. S. W.; towards midnight increasing again to strong gale and furious squalls at intervals. Dense strata rising S. E.

12th October.—A. m. strong squalls and rain, heavy banks of clouds constantly rising from S. S. Eastward; 7 a. m. wind S. b. W.; 9 S. S. W. Noon very unsettled but wind lighter; Lat. Acct. 15° 25' N.; Long. 94° 14' East; Bar. at 8 a. m. 29.70, at Noon the same; Simpiesometer 29.17 and 18; Ther. 62 and 63; p. m. wind S. S. W. thick gloomy weather, wind veering to S. W. occasionally and from E. to South and S. b. E. Clouds dense stratus throughout. Barometer 1 p. m. 29.63; at 5, 29.64; and at 8, 29.67. Simp. at the same hours 29.15, 29.17 at 29.22 to midnight; weather at times inclined to clear up but squalls continuing at intervals.

13th October.—By noon, Lat. Obs. 15° 50' N., Long. 93° 11' East; Bar. 29.73; Simp. 29.26; Ther. 82°; winds variable from S. b. E. 3 or 4 points, with squalls and rain, but weather breaking up and at midnight fine.

*Abridged Extract from the Log of the SCHOONER ENIGMA, (No. 3 on the Chart,) Captain CONNEW, from Singapore to Calcutta. Civil Time.*

Noon 9th Oct. 1848, in Lat. 13° 4' N.; Long. 94° 43' East; Bar. 29.45. Steering to the N. W. b. N. with a strong S. S. W. breeze and drizzling rain. Studding-sails set; p. m. hard gales from S. S. W.

10th Oct.—A. M. moderate breeze. 5 knots, from south. At noon the *Enigma* was in Lat. Acct.  $15^{\circ} 17'$ , N.; Long.  $93^{\circ} 10'$  East, with a fresh gale marked S. S. W. at noon and south P. M. and running to the N. W. 4 P. M. wind S. S. W. 10 P. M. S. W.; strong gales, rain, and hard squalls. Bar. at noon 29.45.

11th Oct.—A. M. strong gales S. S. E. at 8, and S. E. at noon. At daylight moderate, with drizzling rain; studding-sails set. Noon increasing heavy sea throughout; Lat. Acct.  $17^{\circ} 24'$ ; Long.  $90^{\circ} 55'$ . P. M. S. E. b. E. 1.30 P. M. wind hauled to the S. E. in a tremendous squall; to midnight blowing hard and sea getting up.

12th Oct.—A. M. continued heavy squalls; vessel scudding to the N. W. b. W. Noon Lat. Obs.  $19^{\circ} 19'$ ; Long. Chr.  $90^{\circ} 28'$  E.; P. M. wind marked E. S. E.; and at midnight S. E. Strong gales. In the remarks the wind is said to be from E. S. E. to S. S. E. (i. e. up to noon of 13th.)

13th Oct.—A. M. wind about S. E.; 9 A. M. signalized to go to sea from Pilot brig; noon bore N. W. to N. E. b. N.; P. M. lying to with the wind at East; midnight E. S. E.; sunset the gale was tremendous.

14th Oct.—A. M. moderating a little. Lat. Indiff. Obs.  $21^{\circ} 12'$  in 17 ft. 6 P. M. wind south; midnight terrific gale; daylight moderating again, 8 A. M. wind S. W.; noon more moderate; Lat.  $20^{\circ} 53'$ ; P. M. ran into the Pilot station, and up to Saugor.

In a note to me Capt. Connew says: "We brought it up with us from the Sayer Islands (in Lat.  $8^{\circ} 28'$ ; Long.  $97^{\circ} 40'$ ); first in a terrific squall from the S. W. round to south, and then steady, S. S. W. to S. E. till I made the Pilot on the 13th.

At *Kyook Phyo*, on the Arracan Coast, Lat.  $19^{\circ} 26'$ ; Long.  $93^{\circ} 34'$ , from the 9th to the 14th Oct. the Barometer Register with which I am, by the attention of the authorities at that port, regularly furnished, is as follows:—I take only that at noon, as there is nothing notable in the weather, and I give it only to show the limits of fine weather.

| Date. | Bar.  | Ther.        | Winds.                                | Pressure of wind.<br>lbs. per sq. ft. | Sky.    | Remarks.                                                |
|-------|-------|--------------|---------------------------------------|---------------------------------------|---------|---------------------------------------------------------|
| 9th,  | 29.90 | $87^{\circ}$ | { Easterly; N. b. E.<br>to E. S. E. } | 15,                                   | Clear.  | { Light breezes and<br>hot sultry weather.              |
| 10th, | 29.89 | $86^{\circ}$ | E. S. E.                              | 19, "                                 | cloudy. | { Blowing fresh and<br>cloudy.                          |
| 11th, | 29.84 | $81^{\circ}$ | East to E.S.E.                        | 24 "                                  | "       | { Blowing fresh with<br>rain and squally<br>appearance. |
| 12th, | 29.80 | $83^{\circ}$ | East to S.S.E.                        | 22 "                                  | "       | Ditto ditto                                             |
| 13th, | 29.80 | $84^{\circ}$ | { S.S.E.W.N.W.<br>and N. W. }         | 17 "                                  | clear.  | Moderate and fine.                                      |
| 14th, | 29.86 | $81^{\circ}$ | N.W to N.N.W                          | 14 "                                  | "       | Ditto ditto                                             |

The official report from Akyab, through the Superintendent of Marine, and that in reply to a letter addressed by me to Mr. Llewelyn, Harbour Master at that port, say :—

*On the 11th October* the day previous to the new moon, the weather exhibited a wild aspect; cloudy with thunder, lightning and rain during the night, with the wind from Northward and the Eastward; during the day blowing very fresh at intervals; Barometer standing at 29.60.

H. C. Schooner *Spy's* log (at anchor in the harbour of Akyab) forwarded also by Mr. Llewelyn, says—A. M. wind E. S. E.; noon fresh squalls from the Eastward and a heavy swell; midnight moderating.

*On the 12th Oct.* weather cloudy with fresh squalls from E. S. E. Barometer at noon falling to 29.55; during the night squally with thunder, lightning and rain from the Northward and Westward.

*Spy's* log; daylight, wind E. S. E.; noon strong gales and heavy squalls; Bar. 29.65; 8 P. M. wind E. S. E. midnight, weather the same.

*13th Oct.*—Blowing fresh from Eastward and E. S. E., causing a heavy swell in the Harbour, but still had no appearance of a gale; the most remarkable feature was the immense rise of tide, which had never been known by the oldest inhabitants here to have risen to such a height; but it is a fact that the whole coast, from Cheduba to Chittagong during this time was inundated for miles in shore, as well as at this place, evidently showing that it must have been blowing from the S. W. impelling the waters to the Northward: Barometer 29.50.

*Spy's* log A. M. strong gale S. E. and cloudy; noon dark cloudy weather with heavy squalls south. Midnight moderate but squally; Bar. not observed.

*14th Oct.*—Weather still looking wilder, clouds passing with greater velocity from the Eastward, tides still very high; heavy squalls from East and E. S. E. causing a high swell in the Harbour and a very high sea on the bar, and as far as the eye could scan the horizon the weather indicated a very windy appearance, and that there could scarcely be a doubt but a gale was blowing not very far away from this port; Barometer 29.48.

*Spy's* log; wind S. E. and South with a heavy swell

*15th Oct.*—Blowing fresh at intervals, winds veering gradually to S. E.; during the middle of the day heavy squalls from S. E. inclining to the Southward with very heavy gusts of wind at intervals, accompanied with rain; 4 P. M. Barometer commenced to rise, 29.55; the wind towards sunset shifted to Southward and Westward; at daylight of the 16th, the weather resumed quite a settled appearance; Barometer 29.60.\*

\* With this report was also forwarded, copy of the log of the ship *Kirkman Finlay* from Galle to Akyab, and therefore crossing the Bay on a N. E. track, but unfortunately only one position, that of the 10th October, in Lat. 13° 59' N.; Long.

*Chittagong.*

A letter from Chittagong published in the *Calcutta Englishman* of the 30th October, says :—

"The tide at Chittagong was unusually high during the day on Friday the 13th inst., but at high water at night it rose to its utmost height, being 1 foot 7 inches higher than the usual spring tides at the Suddur Ghat. Fortunately it was a very calm night, for a very little wind would have speedily driven the water over the little bunds which protect the adjacent salt golahs, containing at present about 50 lacs of Rupees worth of salt.

"The natives say that the whole island of Kotubdea was submerged, the water being 4 or 5 feet above the river.

"I find that what I have written has not much to do with the cyclone, except as shewing that some unusual influence must have been at work in the Bay to produce the extraordinary high tides here. By the kindness of a friend I am enabled to give the fall of rain at 0 foot 11 inches on the 13th, and 0 foot 05 inches on the 14th. The same authority states that the Barometer was high throughout the two days. As far as I observed the wind, I think it blew chiefly from the South and South-East, especially on the 14th. The tides continued high on the 15th, but gradually diminished."

*Extract from the Log of the Schooner EAGLE, Capt. DARBY, (No. 4, in the Chart,) from Calcutta to Arracan. Reduced to Civil Time.*

On Tuesday, 10th Oct. 1848, the *Eagle* was at noon in Lat.  $19^{\circ} 44' N.$ ; Long.  $90^{\circ} 35' E.$ ; Bar. 29.30; Ther.  $84^{\circ}$ , with a steady E. N. E. breeze and fine weather. P. M. wind easterly till midnight; at sunset smart gales E. b. N. North and East; standing to the S. Eastward.

11th Oct.—A. M. wind East and E. N. E.; daylight heavy squalls from East and N. E.; 8 A. M. wind chopped to E. S. E. Noon moderate and cloudy; Lat.  $19^{\circ} 6'$ ; Long. Indiffr. Obs.  $91^{\circ} 15' East$ ; Bar. 29.15. P. M. moderate with a heavy sea from the East. 2 P. M. squally and weather threatening. Wind P. M. East to E. S. E. strong gales; 4 P. M. smart gales, and set storm main-sail. 6 increasing throughout the night to a heavy gale from E. S. E. with a tremendous high sea. Bar. 8 P. M. 29.15; Simp. 29.00.

$90^{\circ} 36' E.$  with a moderate Southerly gale, is given, and the copyist has most mischievously omitted the distance run, though the course and winds are set down. All that I can glean from it then is, that at noon on the 11th she was under double reefs, wind S. E.; and by 7.30 she hove to with a gale from S. E.; that she continued so during the 12th, wind always S. E., and made sail only at sunset of the 13th, reaching Akyab on the 14th.

12th.—A. M. to noon, heavy gales E. S. E.; hove too on starboard tack Lat. noon  $20^{\circ} 2' N.$ ; Long.  $90^{\circ} 30' East$ . P. M. wind E. S. E.; Bar. 29.20; and at 4 P. M. wind S. E.; 2 P. M. Bar. 29.15; 8 P. M. 29.05; at 12, 28.95. Heavy gales.

13th.—A. M. Bar. 28.90; 6 A. M. 29.05; 10, 29.20; noon 29.20, with a tendency to rise. Noon wind marked S. E. hard gale and squalls with heavy rain; noon Lat. by Acct.  $19^{\circ} 54'$ ; Long.  $89^{\circ} 12'$  P. M. wind S. E. Bar. 2 P. M. 29.20; midnight 29.25. At 11 P. M. wind S. S. E.; Vessel hove too throughout this log; midnight hard gales S. S. E.; heavy thunder and vivid lightning to the S. W.

14th.—A. M. moderating; noon wind south; Lat.  $19^{\circ} 56'$ ; Long.  $88^{\circ} 57'$ ; Bar. 29.25 and rising.

*Abridged Log of the Barque ARARAT, Capt. ROUSE, (No. 5 on the Chart) from Penang to Calcutta. Reduced to Civil Time.*

10th Oct.— $15^{\circ} 41'$ , 92.45, squally, wind S. S. W. studding-sails set.

11th Oct.—Noon in  $17^{\circ} 20'$ ; Long.  $91^{\circ} 37'$ ; Bar. 29.80. Fresh breeze S. E. and cloudy; running 8 knots to the N. W. but at 3 P. M. Bar. 29.60, Cloudy, and ship preparing for bad weather, sea getting up and gale increasing; 5.30 under close reefs.

12th Oct.—6 A. M. wind E. b. N.; 10 E. N. E. Noon N. E. Increasing gale; 11 saw a ship standing to the S. E. Noon Lat. Obs.  $19^{\circ} 11' East$ ; Long.  $89^{\circ} 6'$ ; Bar. 29.50; P. M. strong gale N. E. b. E.; sea getting up, 4 P. M. Bar. 29.45; 10 P. M. very hard gale, Bar. 29.30; midnight cut away the starboard quarter boat.

13th Oct.—6 A. M. wind E. S. E.; gale terrific. Noon Lat. Acct.  $19^{\circ} 31' N.$ , Long.  $88^{\circ} 6'$ ; Bar. 29.00\* P. M. wind N. E.; 2 P. M. Bar. 29.40; 3 P. M. Bar. 29.00; cut away starboard boat; 4 P. M. Bar. 28.6: moderate. Breeze dying away; Bar. 28.70; every thing looking for a "gale or hurricane;" 6.45 P. M. most terrific squall from S.W., sea in a moment very high and the squalls more and more powerful; 8.30 main top sail blew away; Bar. rising to 29.10. Midnight hard gale.

During the calm, or whilst the Barometer was at its lowest point, the ship was surrounded with birds, butterflies, horseflies and all descriptions of flying creatures; one snipe was caught.

14th October.—Daylight more moderate. In 45 fs. water. Noon Lat. Obs.  $19^{\circ} 32' N.$ ; Long.  $86^{\circ} 44' East$ ; Bar. 29.55. Wind W. S. W.

\* An error in copying, we might at first suppose being an oscillation from 29.30 at 10 P. M. 12th to 29.00 at noon, and 29.40 at 2 P. M.; but see *first* the log of the Barham.

*Abridged Log of the Schooner FLORA MACDONALD, Capt. MURCH,  
(No. 6 on the Chart) from Calcutta to Arracan. Civil Time.*

10th Oct.—Light breezes E. N. E. and cloudy. Noon Lat.  $20^{\circ} 34' N.$ ; Long.  $92^{\circ} 15' E.$ : P. M. calm and cloudy weather, current setting N. W.  $2\frac{1}{2}$  knots; came too in 10 fs. water off St. Martin's Island; 9 P. M. wind from E. N. E. and sea getting up. Midnight increasing strong gales and cloudy, with a heavy high sea.

11th Oct.—A. M. wind E. S. E. increasing to strong gale and heavy sea at noon when Lat.  $19^{\circ} 56' N.$ ; Long.  $92^{\circ} 0' E.$  by Acct.; P. M. wind S. E., heavy gales and rain with squalls and gusts at times to midnight.

12th Oct.—Wind E. S. E. strong gales; Lat. noon  $19^{\circ} 47' N.$ ; Long.  $91^{\circ} 10' E.$ ; P. M. wind S. E. b. E.; weather the same to midnight.

13th Oct.—Wind S. E. strong gales and squalls. Noon Lat.  $20^{\circ} 20' N.$ ; Long.  $90^{\circ} 30' E.$  by Acct.; vessel under bare poles; 4 P. M. wind South and S. S. E.; midnight weather the same.

*Abridged Extract from the Log of the Ship BARHAM, Capt. GIMBLETT,  
(commanded by her Chief Officer, Mr. VAILE,\*) (No. 7 on the  
Chart) from Madras to Calcutta. Civil Time.*

Oct. 10th, 1848.—Noon Lat.  $15^{\circ} 40'$ ; Long. Chr.  $86^{\circ} 15'$ ; Bar. 29.72; Simplicometer 29.45; Ther.  $84^{\circ}$ ; P. M. fresh but unsteady breeze northerly, and squally with a heavy swell from the eastward. At 8 hard squalls and heavy sea; making preparations for bad weather; 11 more moderate. Midnight Bar. 29.65; Simp. 29.36.

11th Oct.—A. M. very hard squalls W. N.W. and heavy rain with vivid lightning; 2 A. M. Bar. 29.58; Simp. 29.28. Reduced sails to close-reefed topsails, the clouds having a red appearance, similar to what is observed at sunset; 7 A. M. glass rising† and weather moderating. Noon variable with passing squalls and a confused swell; Lat. Obs.  $15^{\circ} 22' N.$ ; Long.  $87^{\circ} 16'$ . Course S.  $73^{\circ}$  East,  $63'$ ; Bar. 29.68; Simp. 29.38; Ther.  $84$ ; P. M. wind S. Westerly light airs and calms, with squally appearance all round; 3.30; breeze from the S. W.; out 2 reefs; 4 P. M. W. N. Westerly, a strong unsteady breeze with a high sea and much lightning at midnight.

Oct. 12th.—A. M. unsteady breeze N. W. and squally: lightning has a very peculiar appearance similar to the flash of a gun. Barometers rising and falling in a most extraordinary manner these last two days; daylight weather

\* In consequence of a severe accident Captain Gimblett was obliged to remain at Madras. It will be seen that the ship could not have been confided to abler hands.

† The Barometer tide no doubt, but the treacherous moderating as well as the red sky is well worth notice.

moderate and cloudy; Bar. 29.71. Out 2nd reefs. A number of birds flew on board, Snipes, Ringdoves, &c.; 2 A. M. strong breeze with thick weather and much rain; Noon Barometer falling to 29.40; Simpiesometer 29.12; weather very thick with hard squalls and constant heavy rain. Noon hove to under main try-sail and main stay-sail on larboard tack. Lat.  $16^{\circ} 51'$ ; Long. D. R.  $88^{\circ} 23'$ ; P. M. wind W. N. Westerly; weather very threatening, blowing a heavy gale with very hard squalls; 3 P. M. Bar. 29.27; Simp. 29.08; down top gallant yards and masts; 4 P. M. Bar. 29.20; 5, blowing very hard. Ship not moving ahead, but making as far as could be judged, about 3 knots bodily to leeward; 5 P. M. wind veering to West and W. S. W.; 7 P. M. gale still increasing, squalls very heavy. In trysail; under bare poles; the squalls blowing a perfect hurricane; midnight wind S. S. W. Bar. 29.36.

Oct. 13th.—A. M. Blowing very hard, squalls heavier, very high sea; a perfect hurricane; 4 A. M. Bar. 29.48; 5, rather more moderate but still blowing very heavy. At 6 wind S. S. E. Noon fresh gale and hard squalls, Lat. Obs.  $17^{\circ} 52'$  N.; Long.  $89^{\circ} 14'$ ; Bar. 29.58; Simp. 29.30; Ther.  $82^{\circ}$ ; P. M. wind S. S. E.; 5.15 more moderate and fine; bore up north; midnight strong unsteady breeze with hard squalls and much vivid forked lightning.

Oct. 14th.—A. M. wind S. S. E. Increasing again to a gale; hove to again after making  $84'$  to the north; 6 h. 45 A. M. Bar. 29.65. Bore up again; Noon Lat.  $19^{\circ} 43'$  N.; Long.  $88^{\circ} 44'$  East; Bar. 29.70; Simp. 29.40; Ther.  $84\frac{1}{2}$ ; 4 P. M. weather again thick; hove too again.

Oct. 15th.—Wind S. W.; 11 A. M. Ran into the light vessel, Signal to stand to sea; passed many disabled ships. On 16th got the Pilot.

By the attention of Capt. Vaile, I am enabled to add to the capital log of the *Barham*, and to the valuable lesson in Cyclonology which it affords, his remarks upon the signs of the approaching Cyclone so well observed and so carefully recorded in it.

The first of these is the *red sky*, a phenomenon well known in the Mauritius hurricanes and in the China Sea\* Tyfoons, but which was not yet known in those of the Bay of Bengal, or perhaps does not often occur. In this case too we have the singular, and for scientific purposes, very valuable peculiarity that it occurred at night! viz. from two to four A. M. and at a time when the moon was shining as brightly as it could for the clouds; it being the day before the full moon, when she had at that time an altitude of 40 or 50 degrees.

Capt. Vaile states that at this time the whole sky was clouded with dense heavy looking clouds, more of which were opposite to, than on the

\* See Sailor's Horn Book where all that is known of this phenomenon is stated.



side of the moon. The red colour extended over all, but was in patches deeper in some parts than in others, and that some clouds facing the moon were of a deep orange red, and that occurring at night it was the more particularly remarked.

The lightning of the 12th he compares both to the flashes of a gun, and, at times, to sparks as if from a flint and steel. Altogether a most remarkable kind of lightning. Very little lightning during the strength of the Cyclone—not more than three or four times altogether.

The vibration of the Barometer and Simpiesometer was noticed for about two days, on one occasion it amounted to 0.4 (four tenths) in three hours. At 7 A. M. on this day they shook out reefs, for the Bar. had risen to 29.65; and at noon it was again at 29.20, and then rose again before finally falling!

*Abstract Log of the Ship WELLESLEY, Capt. F. ARROW, (No. 8 on the Chart) from Madras to Calcutta. Civil Time.*

10th October, 1848.—In Lat.  $13^{\circ} 40' N.$ ; Long.  $83^{\circ} 45' E.$ ; at noon breeze N. N. W.

11th Oct.—In Lat.  $15^{\circ} 15' N.$ ; Long.  $86^{\circ} 8' E.$ ; at noon breeze N. W. to W. b. N. with dark lurid appearance to the Eastward, getting more dense, and a hot stifling feeling; towards noon clouds flying in dark rugged masses to the westward; upper strata in ridges from the East, sun obscure with red glare on the horizon to W. and S. W. looking like sunset in the middle of the day; shortened sail to prevent nearing it.\* Afternoon arched squalls from the N. E. rose, with vivid lightning; 7 P. M. looking finer; made sail.

12th Oct.—Lat.  $16^{\circ} 20' N.$ ; Long.  $87^{\circ} 00' E.$ ; Bar. 29.60, Simp. 29.08; Ther.  $83^{\circ}$ ; looking very threatening from the northward at daylight and all the lurid appearance of yesterday; double reefed and reefed the courses; wind West; gusty and increasing with sheets of rain at times. 3 P. M. wind West; still more threatening and increasing to a gale; furled every thing and *hove to* under main staysail and trysail. 8 P. M. sent top gallant yards down; blowing a heavy gale from the westward with torrents of rain; 8 P. M. Bar. 29.50; Simp. 29.00; vivid lightning and peals of thunder all round and close over the ship, the rain was the most tremendous I ever saw, and the squalls most furious. Midnight wind commenced veering to S. W.

13th Oct.—Lat.  $16^{\circ} 53' N.$ ; Long.  $88^{\circ} 2' E.$ ; 7 A. M. wind S. W. to S. S. W. bore up E. N. E. to get clear of the Cyclone; under close reefed topsails and reefed foresail; heavy confused sea from all quarters since midnight. Noon wind

\* The Cyclone of which Capt. Arrow was fully aware.

shifting to southward and more moderate and finer weather; bore up my course; weather getting finer but still coming up from the southward in hard squalls.

14th Oct.—Lat.  $19^{\circ} 07' N.$ ; Long.  $88^{\circ} 57' E.$ ; gradually clearing up to a strong southerly breeze, but dark cloudy weather; at 10 P. M. hove to; not liking to approach the Sandheads till the weather cleared; midnight Lat.  $20^{\circ}$ ; strong gale increasing again from the southward, made sail and worked off. I suppose being hove to, the tail of the breeze picked us up again.

15th Oct.—Moderating from the southward.

To some enquiries made by me, Capt. Arrow says:—

“The lurid appearance which is mentioned is that of a deep leaden sky during the day time. There was also to the northward a heavy red glare.

For two days after leaving Madras a remarkable halo round the moon was noticed. It was of considerable brilliancy, and the orange and blue colours very distinct.

The arched squalls were remarkably regular in their formation, resembling those of the Straits of Malacca.

The thunder and lightning were most violent and intense from 8 P. M. 12th to 2 A. M. 13th.

Hot and cold blasts were distinctly felt. I can compare the hot blasts only to the Scirocco of the Mediterranean.

We found a very confused sea after bearing up, evidently where we crossed the track of the Cyclone.”

*Abridged Log and Notes from Capt. HUMPHRIES, Ship SEA PARK (No. 9 in the Chart) from London to Calcutta; reduced to Civil Time.*

From the line to  $14^{\circ} N.$  we had strong westerly breezes with much rain and gloomy weather, with a steady Barometer and very warm weather.

On Wednesday, October 11th.—Lat.  $16^{\circ} 57' N.$ ; Long.  $90^{\circ} 02' East$ ; Bar. at 10 A. M.  $29^{\circ} 70'$ ; Simpiesometer 29.30; winds variable from S. S. W., S. E. and Easterly, with fine weather. P. M. light Easterly breeze, veering to N. E.; 5 P. M. Bar.  $29^{\circ} 60'$ ; Simp. 29.20. At 6 P. M. in 3rd reefs; wind light and variable from N. E. and N. W. through the night. “At sunset a red lurid light in the heavens, but not of such a character as I have remarked off the Cape previous to violent gales, and in fact there was no indication for worse weather except that of the Barometer and Simpiesometer.

12th Oct.—Lat.  $17^{\circ} 54'$ ; Long.  $89^{\circ} 06' East$ ; Bar. 10 A. M. 29.35; light rains and calms; Barometer and Simpiesometer falling at the time when the

*daily rise should take place.* It continued to fall slowly but steadily. Making all preparations for bad weather. Ship covered with land and sea birds and insects which came on board for shelter and would hardly move when in danger of being trodden on. Faint variable airs till about 2h. 30' P. M. when a southerly breeze sprung up, which soon began to blow hard with a most threatening appearance. At 4 P. M. hove too in about Lat.  $18^{\circ} 6' N.$ ; Long.  $89^{\circ} 25' East$ , on the larboard tack. 6.30 P. M. Bar. 29.15; Simp. 28.80. Wind increasing fast at south, and from 8.30 to 10.30 blowing a perfect hurricane but without veering. At 8.30, when the wind was beginning to blow with the greatest fury, the Bar. and Simp. began to rise, and continued to rise steadily. Midnight Bar. 29.30; Simp. 28.95. Wind S. S. E., a hard gale and heavy gusts of wind and rain.

13th Oct.—Daylight wind S. E. very hard gale but Bar. and Simp. continue to rise; noon Lat. Acct.  $18^{\circ} 20' N.$ ; Long. Chr.  $89^{\circ} 26' E.$ ; Bar. 29.63; Simp. 29.35. Saw much wreck in the forenoon; P. M. wind S. b. E. steady southerly gale throughout; gale evidently broken; Bar. and Simp. always rising.

14th Oct.—10 A. M. Bar. 29.75; Simp. 29.32; noon Lat.  $19^{\circ} 25' N.$ ; Long.  $89^{\circ} 05' East$ . A Northerly set of 80' since the time the ship hove too on the 12th.

*Extract from the Log of the Barque ASIATIC, Capt. G. BARLOW,  
(No. 10, on the Chart) from Madras to Calcutta. Civil Time.*

On the 10th October, the *Asiatic* was at 6 P. M. in 55 fs. Lat. at noon  $19^{\circ} 41' N.$ ;  $87^{\circ} 7'$ .

11th Oct.—A. M. light variable breezes, apparently from the N. N. W. and East; ship standing to the N. E. and S. S. E.; sounded in 15 fs.; at 5, 25 fs. noon squally from the North, standing to the East; Lat.  $20^{\circ} 7'$ ; Long.  $86.56'$  East. At 8 P. M. increasing; Bar. 29.60.

12th Oct.—A. M. increasing; close reefs at noon, when wind from the N. E. Lat.  $19^{\circ} 32'$ ; Long.  $88^{\circ} 19' East$ .

|         |            |      |        |
|---------|------------|------|--------|
| 4 P. M. | Bar. 29.40 | 9h.  | 29.26. |
| 5       | ..... .38  | 10.. | .14.   |
| 7       | ..... .33  | 11.. | .10.   |
| 8       | ..... .33  | 12.. | 28.94. |

Midnight wind East, heavy gales but with breaks in the sky at intervals.

13th Oct.—A. M. wind East, hard gales; 7 A. M. E. N. E.; noon Lat.  $19^{\circ} 8'$ ; Long.  $86^{\circ} 8' East$ . 1. 30 A. M. wore and kept away North; at 3 A. M. hove too under bare poles. Noon hurricane from E. N. E.

|           |            |            |             |
|-----------|------------|------------|-------------|
| 1—2 A. M. | Bar. 28.97 | 1 —6 P. M. | Bar. 28.70. |
| 3—4       | ..... .90  | —8         | ..... .60.  |

|             |       |                 |        |
|-------------|-------|-----------------|--------|
| —5 .....    | .96   | —9 .....        | .90.   |
| 6—9 .....   | 29.00 | 10—11 .....     | 29.00. |
| Noon, ..... | 28.86 | 12 midnight, .. | 29.20. |

4 P. M. wind North; at 6 N. b. W.; 8 N. W.; 10 to midnight, West; at 8 blowing a hurricane; impossible to look to windward. Moderating at midnight.

14th Oct.—A. M. wind S. W.; 4 A. M. S. S. E.; 6 South to noon, when Lat. 19° 50' N.; Long. 86° 51' East. Fresh gales.

Bar. 1—2 A. M. 29.40. 8 .... 29.50. Noon, 29.70.

The Ship *Lady Sale*, Captain Castor, though not experiencing any part of the Cyclone, followed it closely up the bay, and taking her to have been on the 12th about a degree from the Wellesley to the Southward—for I have not been able to obtain her position—it shews that either the monsoon was following up the Cyclone, or that its influence extended further to the South, her Bar. register alone could settle this. The following note is sent to me by Capt. Castor:—

“October, 1848.—Lat. 13° 05' to 18° 2' N.; Long. 80° 30' W.; S. 5° 07' E.

From the ninth to the tenth October, while in the Madras roads, the weather was very unsettled, blowing in squalls from N. to N. E. with incessant rain for about 48 hours; dark and gloomy appearance to the N. E. and N.

The “*Lady Sale*” left Madras on the 11th with fine weather, winds from the Westward; on the 12th and 13th experienced very squally weather from S. W. to W.; on the 13th, being farther to the North, it blew stronger from the Westward, with puffs and an irregular swell from N. E. to E., so much so that the vessel pitched her jibboom and flying jibboom away, and was obliged to ease her by reducing sail; winds stronger from the Westward. On the 14th very fine weather with thick huge clouds over the tops of the hills on the coast; anchored on the evening of the 14th, and found the surf very low, the tides uncommonly high, weather clear and pleasant, and continued so for some days.

(Signed) JOHN CASTOR,  
*Lady Sale.*”

*Abridged Log of the Ship BRITISH SOVEREIGN, Capt. HARRIS,  
(No. 20 on the Chart) from London to Calcutta. Civil Time.*

12th Oct.—The ship *British Sovereign* ran up from 7° North in one continued series of squalls and rain, with the exception of about 3h. from 8 to 11 P. M. of the 11th October; wind throughout from W. S. W. to W. N. W. On the night of the 11th the stars had an unusually brilliant appearance, and the heavens were illuminated occasionally with a very red glow.

12th Oct. A. M.—Wind variable from North to W. N. W. with heavy squalls of wind at intervals. At 4 A. M. heavy squalls from the northward, rising with heavy black clouds. At 6, increasing to a steady heavy gale at west, with thick dark weather and incessant rain; making all preparations. Bar. at 1 A. M. 29.60; at 2, 29.59; at 3, 29.57; at 4, 29.55; at 5, 29.52; at 6, 29.50; at 9, 29.50; and at noon 29.50. 10 A. M. wind W. b. S.; noon W. S. W. Lat. Acct. 16° 37'; Long. Acct. 38° 38' E.; wind very steady; set the reefed foresail. Course steered, North. P. M. wind W. S. W. No rain but thick dark cloudy weather and blowing a steady heavy gale. 6 P. M. gale increasing with violent squalls of wind and rain. At 8 P. M. in Lat. 17° 17' N.; Long. 88° 35' East, by Acct. finding the Barometer rapidly falling, squalls rapidly increasing in strength and the weather shewing every appearance of becoming worse, hove to at 9; wind S. W. b. W.; squalls terrific; at 10, worse, with vivid flashes of lightning and heavy thunder, apparently very close. Midnight blowing furiously; wind S. W. with a continuation of heavy thunder and lightning. Barometer at 1 P. M. 29.50; at 4, 29.45; at 6, 29.40; at 7, 29.38; at 8, 29.33; at 9, 29.30; at 10, 29.27; at 11, 29.25; and at midnight 29.20. Capt. Harris considers that he had the heaviest weather from 10 to 11 P. M.

13th Oct.—A. M. wind South; 3 A. M. S. b. E.; at 4, S. S. E.; at 6, S. E.; at 8, S. S. E.; and at 11, South. From 1 to 4 A. M. a heavy gale with rapid gusts of wind, sea rising fast. At 4, gusts decreasing in strength to a hard gale but with a high confused sea; by 8, wind rapidly abating. Noon moderate Lat. by Acct. (and nearly correct) 17° 38' N.; Long. 88° 33'. Bar. at 1 A. M. 29.20; at 2, 29.17; at 3, 29.10; at 4, 29.20; at 5, 29.22; at 6, 29.22; at 7, 29.30; at 8, 29.35; at 10, 29.36; and at noon 29.40.

I have placed this ship in the chart as her run and drift are given, but Capt. Harris states that he had no solar observations for two days previous to the 12th, and in such weather star observations cannot be much depended upon. She was, I have no doubt, farther to the Eastward than she supposes on the 12th, probably about half way between the positions of the *Barham* and *Sea Park*, which would then give her the winds she experienced as the Cyclone moved on and lifted up to make way for the monsoon below it. (See summary.) The Cyclone track also may have curved to the westward at first, for it seems certain that the tornadoes move in waving or oscillating lines, though the average is a straight track, and from analogy we may suppose the Cyclones to do the same.

*Abridged Log of the Barque CHARLES KERR, Capt. H. T. APPLETON, (No. 21 on the Chart) from Mauritius bound to Calcutta, reduced to Civil Time.*

12th October, 1848.—Midnight 11th—12th moderate Northerly breeze and clear. Black Pagoda N. W. b. W. distant 3 miles. At 2 A. M. increasing breeze, ship standing E. N. E.; 4, dark gloomy weather; 8 A. M. wind N. E. to noon; by 10 A. M. fresh gale and showers of rain; noon hard gales, heavy squalls and rain and confused sea; Lat. by Acct.  $19^{\circ} 36'$ ; Long.  $87^{\circ} 52'$ ; Bar. 29.60; Simp. 29.30; Ther.  $82^{\circ}$ . P. M. hard gales N. N. E.; making all snug; 8 P. M. the same; midnight wind North; Bar. 29.50; Simp. 29.20; Ther.  $80^{\circ}$ .

13th Oct.—Gale increasing to noon when heavy; veering by 10 A. M. to W. N. W. pumps choked by sand ballast, and kept ship before the wind to 9 A. M. Had made since noon 12th, 32 miles due South; noon dense atmosphere, torrents of rain and sleet;\* all hands bailing; Lat. Acct.  $19^{\circ} 02'$ ; Long.  $87^{\circ} 27'$ ; Bar. 28.90; Simp. 28.70; Ther.  $79^{\circ}$ . P. M. wind S. W. b. S. 2 P. M. glasses began to rise. 7 P. M. wind South. 8 P. M. Bar. 29.20; Simp. 29.10. Heavy gale throughout; ship running to N. N. E. and N. E. 6 and 7 knots. Lost main-topmast and mizen topmast, at midnight more moderate.

14th Oct.—A. M. wind South. 5 A. M. S. S. W. to noon; by 10 A. M. fresh breeze; Lat. noon  $20^{\circ} 14' N.$ ; Long.  $88^{\circ} 42'$ . Bar. 29.60; Simp. 29.40; Ther.  $83^{\circ}$ . After which made the Pilot.

Capt. Kerr's private note book, kindly placed in my hands, says, after describing the veering of wind. "Throughout there was a dense atmosphere and torrents of rain and sleet when blowing from the N. W. The Bar. and Simp. gave timely notice, but nothing was remarkable in the sky prior to its commencement, with the exception of an unusual bright appearance and twinkling of the stars on the night of the 12th. The Bar. 28.9; and Simp. 28.7 at noon on the 13th, when at its height, and a few hours afterwards, they began to rise. On the night of the 13th,† a very heavy swell was setting in from the Eastward, which broke very high on the beach near the Black Pagoda. The sea very luminous and occasionally some thin white clouds passed rapidly over the moon from the N. Eastward.

\* This sleet was, Capt. Appleton informs me true sleet, i. e. rain and snow with small hailstones, while the wind was between N. and W. When it hauled to the Southward it ceased.

† So in MSS.; 11th and 12th meant.

*Abridged Log of the ship SIR ROBERT SEPPINGS, Captain STUART,  
(No. 22 on the Chart), from Columbo to Calcutta, reduced to Civil  
Time.*

October 10th, 1848.—At noon light airs and hot sultry weather, Ganjam bearing N. W. dist. 20 miles; Lat. Obs.  $19^{\circ} 15'$  North; Bar. 30.9; Ther.  $90^{\circ}$ . P. M. light variable winds, standing to the Eastward. Midnight wind N. W. *Memorandum.* This ship had been on the 6th in sight of Juggernath Pagoda, but had been set down the coast by the baffling winds and the Southerly current.

Oct. 11th.—To noon standing to the Eastward with a fresh Northerly and N. N. Easterly breeze and a heavy head sea. At noon Lat.  $18^{\circ} 55'$  North; Long.  $86^{\circ} 18'$  East; a current setting to the S. S. W. 2 miles per hour. Bar. 29.90; Ther.  $89^{\circ}$ . P. M. fresh breeze with a heavy head sea; standing to the Eastward  $2\frac{1}{2}$  to 4 knots, with variable northerly breezes. 8 P. M. squally and rain, with a dark threatening appearance; ship pitching very heavily. Midnight strong breezes from the Northward; much lightning to the Eastward.

12th Oct.—3 A. M. *more moderate.* At 8 strong breezes Northerly, with a very threatening appearance; increasing at noon with hard squalls, when Lat. Oct.  $19^{\circ} 27'$  N.; Long.  $87^{\circ} 20'$  East. Standing to the Eastward; Bar. 29.70; Ther.  $86^{\circ}$ . P. M. Wind North strong gales, heavy squalls and rain;  $5\frac{1}{2}$  P. M. making all preparations for bad weather; down Royal yards and close reefing. 8 P. M. Bar. 29.55; gale increasing with a very threatening appearance; hove too under main trysail. Midnight hard gales and heavy rain; Bar. 29.50.

13th Oct.—At 2 A. M. *more moderate and Barometer rising.* Set reefed foresail and main topsail; at 4 again hove to, gale increasing and Barometer falling to 29.20. To noon wind always East, to N. E. at noon, when Lat. by Acct.  $19^{\circ} 40'$  N.; Long. Acct.  $88^{\circ} 00'$ ; P. M. wind marked N. E., hard gales. 2 P. M. *more moderate*, set foresail and main topsail again; wind S. E. Bar. 29.40; 4 hard squalls and heavy rain, Bar. falling to 29.10; at 5 P. M. wind marked S. S. E. 6 P. M. weather more threatening, took in foresail and main topsail, both of which blew to pieces. The furled sails now blowing from the yards; wind S. E. to South. 7 P. M. wind S. S. W., ship on her beam ends, main and mizen masts and foretopmast went by the board. 8 P. M. wind South; pumps choked, crew baling; midnight a continuation of heavy gales, wind veering from S. E. to S. S. W. Position during the height of the hurricane was about  $19.30$  N.  $87.35$  East.

14th Oct.—1 A. M. wind S. S. W.; 4 A. M. South; 9 A. M. S. b. E. to noon; 4 A. M. the same weather; at 8 *more moderate* to noon, when Lat. Obs.  $19^{\circ} 45'$  N.; Long.  $87^{\circ} 50'$  East; Bar. 29.1; Ther.  $79^{\circ}$ . P. M. wind S. S. W. Moderating to midnight, when wind S. b. W.—noon Lat.  $19^{\circ} 45'$ ; Long.  $87^{\circ} 50'$ ; Barometer broken in the height of the tempest.

To the foregoing, which is partly from the ship's log and partly from a note obligingly sent me by Capt. Stuart, he adds :—

"I must observe that for several days previous to the hurricane the weather assumed throughout the day a very unusual appearance, with light baffling winds and hot sultry weather. Ther. from  $86^{\circ}$  to  $92^{\circ}$ ; a misty horizon and at night a misty circle round the moon and an unusual twinkling of the stars. An immense number of both sea and land birds were constantly about the ship, with much lightning from the Eastward and South Eastward at times.

*Abstract from the Log of the ship CAMPERDOWN (No. 12 on the Chart), Captain CUMBERLAND, from London to Calcutta. Civil Time.*

At noon on the 10th October, 1848, the Floating light bore N. E. b. N. 50 miles, Lat. Obs.  $20^{\circ} 17' N.$ ; by 6 o'clock we had run about 25 miles, on a N. E. course, when we saw a vessel, which we supposed to be a Pilot Brig, as she was running down to a ship at anchor, bearing N. E. from us dist. about 8 miles; at this time it had fallen calm and we found there was a strong current running to the S. W. but, as the water was too deep for the bower, let go the kedje and veered a hawser, which only checked, but did not stop her from driving. Soon after (about 7 P. M.) a light breeze sprung up; weighed the kedje and stood N. W. a few miles, but finding the wind falling light and the ship refusing to steer with a 5 knot breeze, again let go the kedje and veered 2 hawsers; the ship still driving; the current appeared to be running about 3 knots.

*Wednesday, 11th October.*—A light breeze springing up, weighed the kedje and stood to the N. East about 15 miles, but at 4 tacked, as she broke off to N. b. E., and knowing the current was running very strong, I was afraid of being driven to leeward, intended to stand well to the Southward to get out of the strong current. 6 A. M. Lat. by Sirius  $20^{\circ} 51'$ , stood S. E. all the day; at daylight saw a steamer steering to the Southward; noon squally and rain, Lat. Obs.  $20^{\circ} 32' N.$  There was no appearance of bad weather this day; P. M. cross sea. 3 P. M. in 1st reefs; there were a few light showers, but the clouds had little motion.

*Thursday, 12th Oct.*—Tacked and stood to the northward; saw a Pilot brig at anchor and a ship. At 11, the brig signalled us to stand to sea till the weather moderated. At this time the weather was not bad, but the Barometer had begun to fall, 29.60; noon Pilot vessel N. N. E.  $15'$ . Tacked and stood S. E. In 3rd reefs. At 11 P. M. hard squalls.

*Friday, 13th Oct.*—Weather looking bad, close reefed the main topsail; at 3 A. M. Bar. 29.20. Prepared for a gale: blowing very hard during the day



from E. N. E. to East. At noon wind at S. East; Bar. 29.00. At 5 P. M. Bar. 28.90. At 6, 28.70. At 7, 28.50; secured the sails before dark; furled the main topsail, and prepared for a hurricane, manned the pumps, and got life lines along the deck. From 7h. to 7.30 P. M. a lull, but the Bar. was still inclined to fall. Expected a shift to the Southward and more wind; *at this particular time, the weather was fine overhead*; 7.30 hurricane from the W. S. W. About 8, the wind drew gradually round to South and S. S. W. and by  $\frac{1}{2}$  past 8 the wind was blowing a perfect hurricane, with hard rain, the wind not blowing steadily, but in gusts; expected the masts to go over the side every moment; got axes all ready to cut away, sent the carpenter down in the well and ascertained that the ship was perfectly tight, it being of course impossible to sound the pumps with any degree of accuracy, owing to the quantity of water taken in to leeward; at this time the lee hammock nettings were washed away, the lee quarter boat, and the main and mizen royal masts; the foretop gallant mast was fortunately housed, but we had not time to house the others; had the foretop gallantmast been up we should certainly have lost the foretopmast. The Barometer at midnight 28.50, began to rise soon after the shift, and continued to rise through the greatest strength of the gale. I think the hurricane did not last in its greatest strength more than 2 or 3 hours, but of that I cannot be certain.

*Saturday, 14th October.*—At 1 A. M. Bar. 29° 00'; not so much wind, but still blowing a heavy gale from S. S. W. At daylight found ourselves in 17 fathoms. False Point N. W. 7 miles. Set the foresail and wore to the Eastward. At noon a fresh gale, Bar. rising 29.40.

*Sunday, 15th Oct.*—Unsettled weather, blowing fresh from the Southward; at 6 P. M. saw the Pilot Brig at anchor off the South Buoy, passed under his stern, told us he had not got any pilots, and sent us to sea again; stood to the S. East all night from this time; had light baffling winds till Tuesday 17th. At 8 P. M. got up to the light vessel, and received a Pilot on board. The last 2 or 3 days saw many vessels totally dismasted; boarded the Collingwood, totally dismasted, and offered any assistance in our power.

*Abridged Log of the Ship COLINGWOOD, Capt. MOLISON (No. 13 on the Chart,) from England to Calcutta with troops on board—reduced to Civil Time. The force of the wind marked by the Admiralty numbers.*

On the 11th October, 1848, at Noon, the *Colingwood* was in Lat. 16° 21 N.; Long. 88° 38' East, standing to the N. W. with fine weather, a four and five knot breeze from the N. Eastward; Bar. at noon 29.67; Ther. 83°. P. M. cloudy and passing showers—wind variable from the Northward, West and N. East, to midnight.

12th October.—Winds variable from the N. Westward, with cloudy weather and squally at times ; ship standing 5 and 6 knots to the N. N. E. and N. E. At noon Lat. by Acct.  $17^{\circ} 46' N.$  ; Long.  $89^{\circ} 6' East$  ; Bar. 29.37. P. M. A ship in sight to the N. N. W. standing S. E. under close reefed topsails, with top gallant masts down, 3 P. M. Bar. 29.25, and falling fast since noon ; made preparations for bad weather. P. M. wind variable from N. Wd. ; at 4, Westerly ; 5, S. Westerly ; at 7, S. b. E., at 8 S. S. E. and at 10 S. E. b. S., force increasing from 4 to 9 to midnight ; ship running to the N. E. b. N., North and N. N. W. from 4 to 10 knots. Midnight Lat. by Acct.  $18^{\circ} 55'$  ; Long  $88^{\circ} 44' E.$  High sea getting up ; Bar. 29.25.

13th October.—3 A. M. Bar. 29.30 ; at 8h 30'. 29.40. Set foresail ; at 11 h. Bar. 29.45 ; wind S. E. b. S. to 6, when E. S. E. ; at 8 East and at noon E. S. E. force 8. Lat. Obs.  $20^{\circ} 27' N.$  ; \* Long. about  $87.35$ , according to Capt. Molison, Bar. noon 29.50 ; Ther.  $82^{\circ}$ . P. M. Moderate gale (force 8) E. b. N. cloudy, gloomy, hazy and constant rain ; 1 h. 36. in 35 fs. water off Cape Palmiras 4 P. M. Bar. 29.40, at 6, 29.20 ; wind E. N. E. (9). Gale increasing ; 7.30, a perfect hurricane, with thick hard rain ; Bar. 29.00 ; wind E. S. E. (11—12). At 8 Bar. 21.80. Soon after 7. 30. P. M. lost bowsprit and foremast and main and mizen topmasts, quarter boats, &c. At 10 wind veering to S. E. (10) at 12 Southerly (11—12) Bar. 29.05, hurricane raging with the utmost fury.

14th Oct.—3 A. M. wind S. S. W. ; 4 Bar. 29.30, hurricane moderating ; 5. 30 A. M. saw False Point Light house S. W. ; sounded in 7 fathoms water. At 6 came too in 5 f. False Point Light S. b. W. To noon gale decreasing from S. b. W.

*Abstract from the Log of the ship EDMUNDSBURY, Capt. REDPATH, (No. 14 on the Chart,) from Ceylon bound to Calcutta—reduced to Civil Time.*

I am indebted to Mr. Thos. Scallan of the Pilot service, for some notes corrective of this ship's log, arising from errors of the copyist, or from the confusion incident to vessels on their beam ends with their ballast shifted, in a hurricane. It was probably filled up from recollection, and contained some evident oversights.

\* The true position is about  $18^{\circ} 40'$  ; Long.  $88^{\circ} 44'$ . The Log is very carefully marked, but it gives  $31'$  more of northing than the observation of the following day, which I take to be owing to the southerly current off Point Palmiras, arising from the curving of the Easterly set over the Sand Heads, as will be shewn in the remarks. The current was probably much heavier, for the ship had, no doubt, the storm current and perhaps a little of the storm wave in her favour.

The *Edmundsbury* at noon on the 11th October had received her Pilot on board in the course of the morning, and had at noon the outer Floating Light bearing E. b. S. 10 miles; winds variable from E. S. E. and squally. 2 P. M. came too in 5 fs. 3.45, commenced weighing, and at 6.30 stood to sea with a strong breeze at E. N. E. 8 P. M. increasing; midnight, Bar. 29.65.

12th Oct.—4 A. M. increasing and threatening appearance, making all preparations; noon Bar. 29.60. Fresh gale, strong squalls and heavy appearance to the Eastward, wind varying from N. E. to East. P. M. Lat. by double Alt.  $19^{\circ} 53'$ ; Long.  $88^{\circ} 11'$  East; Bar. 29.60. Increasing strong gales E. N. E. and at 5 P. M. East to N. E.; 8 P. M. Bar. 29.58; 10 P. M. 29.56; midnight 29.50. Blowing a hard gale.

13th Oct.—A. M. wind N. E.; 4 A. M. increasing, with threatening appearances; at 8 A. M. made every thing snug for bad weather. Noon hard gale and dark cloudy weather; Bar. 4 A. M. 29.40; 8h. 29.30; noon 29.20; Lat. Acct.  $19^{\circ} 21'$ ; Long.  $87^{\circ} 49'$  E. P. M. hurricane at N. E., ship under bare poles. 4 P. M. more moderate. 5 P. M. dead calm, tremendous cross sea; Barometer falling fast, 28.90. Drizzling rain with threatening appearance to the N. W.; heavy bank rising fast to the South. Trimmed ballast which had shifted. 6.30 P. M. commenced blowing from the N. W. and veering to the Westward; at 8, blew a hurricane; Bar. 28.40; ship lying on her beam-ends and refusing to wear. Winds at 5 P. M. marked N. W.; at 7 P. M. W. b. N. and at midnight a furious hurricane S. W. lulling a little; all hands by the axes for cutting away.

|                       |                       |
|-----------------------|-----------------------|
| 1h. P. M. Bar. 29.18. | 7h. P. M. Bar. 28.60. |
| 2 ..... .00.          | 8 ..... .65.          |
| 3 ..... 28.90.        | 9 ..... .75.          |
| 4 ..... .80.          | 10 ..... .80.         |
| 5 ..... 28.60.        | 11 ..... .86.         |
| 6 ..... 28.40.        | 12 ..... .98.         |

14th Oct.—2 A. M. lulling a little; Bar. rising fast, wind S. W. Bar. 28.90. By 4 A. M. wind had veered to S. S. W.† half past 4 wore and stood to the E. N. E. At daylight saw the *Framjee Cowasjee*; passed her at 7 A. M. in Lat.  $19^{\circ} 45'$  N.; Long.  $86^{\circ} 38'$  East. Noon a large ship to the N. W. b. W. with foremast, bowsprit and stump of mizen mast standing. Another to the S. S. E. with her foremast and topmasts gone, both dist. abt. 5 miles Noon Lat. Obs.  $20^{\circ} 2'$ ; Long.  $87^{\circ} 7'$  East. Winds marked, 5 P. M. S. S. W.; 7, South; and at 11, South.

\* Pilot's note S. W.

|                |        |                |        |
|----------------|--------|----------------|--------|
| 1h. A. M. Bar. | 29.00. | 7h. A. M. Bar. | 29.50. |
| 2 .....        | .14.   | 8 .....        | .60.   |
| 3 .....        | .20.   | 9 .....        | .60.   |
| 4 .....        | .30.   | 10 .....       | .60.   |
| 5 .....        | .35.   | 11 .....       | .60.   |
| 6 .....        | .40.   | 12 ... ..      | .60.   |

P. M. by midnight had run into 27 fs. with fresh gales and cloudy weather from S. S. E. and at 3.30 A. M. of the 15th, saw the light vessel's signals again.

Capt. Redpath adds in reply to my queries, that on Tuesday 10th, at sunrise, he remarked a dull lead coloured sky to the S. E. but it cleared away by 8 A. M. of that day. He experienced no lightning at any time during the Cyclone. When at the calm centre it was much lighter overhead; the appearance like the breaking up of a heavy gale, but after one hour a dark heavy bank formed to the N. W. in the form of an arch. The ship was surrounded by birds of various kinds and amongst the rest they caught a parrot; swallows, gulls, boobies, &c.; all quite exhausted.

After the Cyclone a dull heavy appearance to the N. W.

*Abridged Log of the ship FRAMJEE COWASJEE, Capt. EDWARDS, (No. 15 on the Chart,) from England to Calcutta—reduced to Civil Time.*

The *Framjee Cowasjee* had received a Pilot on board on the 11th October, at 7h. 30' A. M. At noon the floating light bore East and the South Channel Buoy S. S. W. P. M. wind E. N. E.; wind light from E. N. E. Midnight light breeze, rain; out 2d reefs topsails.

12th Oct.—6 A. M. to noon heavy squalls working to the Eastward; Bar, 29.46; Lat. by Acc. abt. 20° 18'; Long. 88° 27' East; 2½ miles per hour of westerly set being allowed. P. M. to midnight increasing gale from E. b. N. Ship standing to S. E. b. S. and at 9.31 P. M. hove too,

13th Oct.—Heavy gale E. N. E.; noon Bar. 29.44. P. M. wind marked E. b. N. high sea and tremendous gusts increasing to a hurricane. 5 P. M. moderating to a gale with vivid lightning to the westward; at 6, wind *hauling* to the Northward and round to the S. W. braced round on the starboard tack with head to the Eastward; wind W. S. W.; at 8, lulling to a calm with a very high sea. Calm lasting till 9 P. M., when it commenced to blow and increased to a fearful hurricane. Midnight still increasing, Bar. 8 P. M. 28.52; at 11, 28.72; at midnight 28.90.

\* So in Log, but evidently an error, and that 28.44 is meant.

14th Oct.—A. M. blowing a violent hurricane from S. W. 5 A. M. lost main and mizen masts. Barometer 1.30; A. M. 29.10; at 2h. 30' 29.22; at daylight was passed by the *Edmundsbury* in Lat. 19° 45' N.; Long. 86° 38' East. Noon moderating and fine with a very high sea; 8h. wind strong; at 2 P. M. saved five hands from about 47 of the crew of the *Hope* which had foundered; her crew had constructed rafts which the *Rustomjee* could not succour as she was unmanageable.

#### FALSE POINT PALMIRAS.

*From MR. BARCKLEY, the Superintendent of False Point Light-house, I have the following memorandum taken down verbally from his information.*

Gale commenced on the 12th with heavy squalls N. E. to N. W.; between 12th and 13th blowing N. N. E. and always increasing; began to blow steadily on to 13th from the N. E. and on the night of that day very heavy.

A shift took place to N. N. W. at about 9½ P. M. of the 13th with high water. Then it fell a dead calm at 10, which lasted to 12½ or 0.½ A. M. the rain clearing off: saw the stars very clear over head, but a thick bank of haze all round. At 12½ breeze fresh and very stormy from S. S. E. to a complete hurricane, which lasted about seven hours, varying only two or three points more to the Southward.

The rise of tide, which was about 9 ft. more than usual\* (entire rise 17 ft. high) came in with a rush like the bore. I saw it come in a heavy foaming surge of a wave like the surf outside of Plowden's Island;† I heard it coming in and went up to see what it was; and from the gallery of the Light House saw it distinctly. I at first thought it was the Island being washed away. This bore came in about two o'clock in the morning‡ when the hurricane had reached its full height from the Southward. It was a bright moonlight night, clear over head and cloudy almost in a circle towards the horizon. During the whole time it was blowing there was no lightning, but during the calm there was some forked lightning, mostly from the Northward and Westward,

\* In this estimate Mr. Bond, Master Attendant of Balasore agrees.

† At the entrance of the mouth of the Mahanuddy on the North shore, on which the Light House stands.

‡ When the tide therefore was at three quarters ebb.

It began from the N. Westward. The natives never know such a rise of tide before. At Puttamundy and Hall and Sunkse, to the North and Eastward, the tide rose 19 or 20 ft. in all, or about 11 ft. above its usual height. These places are on the North side of False Bay; about 6 or 700 natives were drowned: all their huts destroyed and cattle drowned. Water remaining for about three days, all the while the wind was to the S. E. not falling more than 4 ft. and it was only when it veered to the Westward that it went down very rapidly."

It would appear from this very valuable note that the centre passed over the False Point Light House on the night of the 13th, at 11 p. m. In stating the date from which the track is laid down, and in the observations, I shall advert at length to the evidence we have here of the storm wave.

#### BALASORE.

From this station I have the following report, through the Superintendent of Marine, by A. Bond, Esq. the Master Attendant there.

Report of Weather at Balasore, 10th to 15th October, 1848.

| Month.   | Date. | Mean Bar. | Bar. per hour.             | Ther. Mean. | Remarks.                                                                                                 |
|----------|-------|-----------|----------------------------|-------------|----------------------------------------------------------------------------------------------------------|
| October. | 10th  | 29.72.    | 29. { .74.<br>.72.<br>.70. | 84°. {      | S. E. to N. W. with rain, cloudy.                                                                        |
| "        | 11th  | 29.68.    | { .72.<br>.68.<br>.64.     | 83½. {      | S. E. to N. W. lightning & S. E. Eastward and West; rain from S. E. with heavy clouds.                   |
| "        | 12th  | 29.64.    | { .66.<br>.65.<br>.61.     | 82½. {      | N. W. breeze, very cloudy and rain & N. E. with heavy gusts of wind.                                     |
| "        | 13th  | 29.60.    | { .63.<br>.60.<br>.57.     | 82. {       | Wind shifting & E. N. E. to E. S. E. with heavy rain; another tier of clouds above travelling from S. W. |
| "        | 14th  | 29.49.    | { .53.<br>.48.<br>.47.     | 81. {       | Rise of water at the Tide Gauge 21 feet, being 8 ft. above spring tides. Wind E. N. E. at 6 p. m.        |
| "        | 15th  | 29.68.    | { .60.<br>.69.<br>.75.     | 81. {       | Shifting to East and E. S. E. at high water ½ past 9 wind increasing in stronger gusts with              |

Wind S. W. and fair.

heavy rain till 1 a. m. of the 15th October, when the wind gradually veered round from S. E. to South, and cleared up at S. W. with passing showers; Barometer 29.60 at 8 a. m.

*Remarks.*

On the 14th instant it appeared clearer at intervals through the clouds to the Westward, as if inclined to break up, and from the deposition of a servant who was at False Bay at the time, he says "the wind was from the N. E. on the 11th with heavy rain, and the wind blew in very heavy gusts. On the 12th wind & S. E. with strong gusts and heavy continual rain. The 13th, the wind from S. E. blowing a hurricane till 2 P. M. of the 14th instant, when it cleared up with wind at S. W., and it is reported that the sea broke into the villages near False Bay, and that numbers of lives have been lost. The Arab ship "*Abassee*" went on shore on the 14th instant at False Bay, dragging her anchors from 9 fathoms, more from the very heavy sea running than from the wind, which on the 14th had abated.

The gale seems to have increased as it extended to the S. W., as the damage is by far the greatest to the S. W.

A. BOND,

*Master Attendant.*

*Balalore, M. A. Office, the 25th October, 1848.*

*Abstract of the Log of the American ship WASHINGTON ALSTON, Capt. DAY, (No. 16 on the Chart,) outward bound; reduced to Civil Time.*

11th Oct. 1848.—The *Washington Alston*, at 11 A. M. on the 10th Oct, had the light vessel bearing N. E. b. E. 10 or 11 miles, and A. M. on the 11th to noon stood to the S. S. W. and S. S. E. and S. E. b. S. with light Easterly baffling breezes till noon when in Lat.  $20^{\circ} 15' N.$ ; Long. by account about  $88^{\circ} 36'$  East. P. M. squally rain, and large sea; midnight more moderate. Ship standing to the S. S. E. and S. E. and S. b. E. Wind is marked E. N. E. but I take it to have been from E. N. E. to E. S. E. by the courses. I allow also 1 mile per hour of current to the Westward for the average of the set over the Sandheads.

12th Oct.—A. M. squally. Noon hard squalls and heavy sea, no observation; wind E. N. E. Lat. by account  $19^{\circ} 02'$ ; Long.  $88^{\circ} 46'$  East; taking in second reefs, and reducing sail; shipping much water. P. M. heavy gales, wind E. N. E. 5 P. M. East. 5.30 hove too. 10 P. M. S. E. Midnight very heavy gales.

13th Oct.—A. M. heavy gales, ship all under water; 1.30, ship full of water fore and aft, hove deck load over board. Before noon foremast and head of the mainmast went, nothing standing but the mizen mast and broken main mast, and the mate and a man overboard. Wind at 6 A. M. S. S. E. and at noon South, after which not marked; estimated position when dismasted Lat.  $19.44$ , Long.  $88.03$  East; allowing  $60'$  of drift to the N. W.

14th Oct.—Morning gale abated. No position given at noon P. M. wind marked S. W. blowing hard all night.

15th Oct.—Noon Lat.  $19^{\circ} 52' N.$ ; after which fine weather.

It was the 19th November before this disabled ship could get in far enough to get a Steamer !

*Abridged Notes from the Log of the Schooner JOHN HEPBURN, Captain PLUM, (No. 17 on the Chart) from Calcutta bound to Penang. Civil Time.*

The Schooner *John Hepburn*, left the Pilot on the 7th October, in the evening, and had light variable winds to—

*Tuesday, October 10th, 1848.*—A. M. wind light and variable from East to E. N. E. steering to the S. Eastward. Noon Lat. Obs.  $19^{\circ} 28' N.$ ; Long. Chr.  $88^{\circ} 33' E.$ ; Barometer 29.67; Ther.  $87^{\circ}$ . P. M. moderate light breeze and fine; sunset weather becoming unsettled, clouds rising up from the Eastward, at times squally; and a swell from the South Eastward. Midnight same weather, vessel pitching heavily and taking in much water forward.

*Wednesday, Oct. 11th,*—A. M. squally W. Noon light winds, squally from E. N. Eastward; Lat. Obs.  $18^{\circ} 18' N.$ ; Long. Chr.  $89^{\circ} 6' E.$ ; Barometer 29.61; Ther.  $86^{\circ}$ . P. M. cloudy threatening weather, winds light and variable from E. N. E. to S. E.; and a *heavy swell from S. E.*; Barometer 29.50. Sunset, steady breezes and cloudy weather; midnight, swell heavy from S. E. and dark cloudy weather.

*Thursday, Oct. 12th,*—A. M. wind light and variable from N. Eastward and a *very threatening appearance to the S. W.*, standing close hauled to the S. E. to Eastward; Barometer 29.38. Daylight a ship to the S. Westward under storm sail, standing to the Northward, distance about  $1\frac{1}{2}$  miles. At 7 Bar. 29.30; Ther.  $82^{\circ}$ . Heavy clouds to the Eastward and a *dense black appearance to the S. Westward*. At 9, light winds from S. Eastward; vessel on starboard tack; heading up N. E. to E. N. E. a heavy swell from S. Eastward. Noon moderate winds and squally weather with rain; Lat. Acct.  $17^{\circ} 35' N.$ ; Long. Acct.  $89^{\circ} 36' E.$  Barometer 29.25.

P. M. wind increasing and a very high sea; Barometer falling fast, 29.20. At 2.30 strong gales and a tremendous high sea; wind S. E.; hove too under balance reefed, mainsail and a small fore staysail. At 4, gale increasing considerably; vessel lurching heavily and shipping great quantities of water over all, and to leeward, unable to look to windward for rain and spray, which blew along with great violence. At 5, shipped a very heavy sea abaft the main rigging, which filled the decks and tore away the balance reef of mainsail, &c. got a small staysail up to the mainmast to keep her too. At 6, blowing extremely hard, especially in the squalls. Barometer 29.15; vessel's lee rail and part of the deck under water. At 9, Barometer 29.9, and weather very bad, blowing a perfect hurricane. At 10, the new inner staysail blew out of the bolt ropes—all hands at the pumps. Midnight ditto weather, vessel's head N. E. to E. N. E.



*Friday, October 13th.*—A. M. bad weather. At 2, moderating a little and Barometer on the rise, but still blowing a very heavy gale and seas breaking over the vessel in all directions; pumps constantly going. Daylight Barometer up to 29.50; and a very high irregular sea, wind veering to the Southward. Noon strong winds and a high confused sea; Lat. Acct.  $18^{\circ} 15' N.$ ; Long.  $89^{\circ} 46' E.$ ; Barometer 29.59.

P. M. ditto weather; wind Southerly, after which it became fine. By observation on the 14th in Lat.  $19^{\circ} 31' N.$ ; Long.  $90^{\circ} 31' E.$ ; having experienced a strong current to the North during the Cyclone, and Captain Plum adds that there was neither thunder nor lightning, while it lasted, with him.

*Abridged Log of the Barque EASURAIN, Capt. SHIRE (No. 18 on the Chart), from Calcutta to Bushire; reduced to Civil Time.*

*Tuesday 10th Oct.*—Pilot left at 2 A. M. Noon lower floating height bore E.  $\frac{1}{2}$  N. in 8 fs. water; Bar. 29.62; Lat.  $21^{\circ} 6' N.$ ; Long.  $86^{\circ} 6'$ . Light airs S. E. and fine clear weather. Midnight fresh breezes about E. b. S. and fine clear weather.

*11th Oct.*—At 3 A. M. wind E. b. S.; at 7, N. N. E.; a 4 knot breeze; from daylight to noon squalls and rain. Ship standing to the S. S. W.; Lat. Acct.  $19^{\circ} 36'$ ; Long.  $87^{\circ} 38'$ . P. M. wind North and at 9, N. E.; 5 to 4 knots. Cloudy, squally, and rainy weather. P. M. course S. W. b. S.

*12th Oct.*—At 2 A. M. wind N. W. freshening gale; at 8 A. M. wind W. b. N. 5 to 7 knot breeze. Noon Lat.  $17^{\circ} 05' N.$ ; Long.  $86^{\circ} 06' E.$  P. M. moderating wind N. W. b. W. and N. N. W.; 6 to 2 knots. At 8, light airs.

*Abridged Report of Mr. T. BELL, Mate Pilot, B. P. S. in charge of the Arab ship Forth. Civil Time.*

*On the 13th Oct.*—At noon saw the outer floating light bearing S. b. W. ship standing to sea with a fresh breeze E. b. N. and beginning to feel the strong set to the westward; passed about 1 mile to leeward of the Floating Light and was signalized to stand to sea. Shortly after he estimates to be making a W. S. W. course though steering S. b. W. At sunset spoke the *Camperdown* and told her to stand to sea, but could not board her. Towards midnight gale increased, wind about N. E., running with it on the quarter (or about South) blowing furiously, all sails, furled or set, blown from the yards.

*14th Oct.*—All hands continually at the pumps to keep the water down to 3 or 4 feet in the hold. All we could do was to scud dead before it. Vessel steering remarkably well, daylight wind N. N. E.; during the day blowing furiously. 2 P. M. a little lighter and shifted to N. b. W. At 5 P. M. we had the strength of the hurricane from about N. b. W. Carried away fore and mizen topmasts. Pilot steering himself to prevent her broaching too. Hove overboard

guns and every thing on deck ; till midnight, wind and sea dreadful from N. W. to W. N. W.

15th Oct.—Breeze gradually moderate towards daylight. At noon by Observation in Lat.  $19^{\circ} 58'$  N. ; Longitude not remembered. Pilot station bearing about N. N. E.

*Ship FUTTAY ALUM bound to Calcutta. Abstract of her log forwarded by Mr. HAGGARD of the H. C. P. S.*

This log is unfortunately only an abstract and I am unable to calculate from it the ship's position on the different days of the Cyclone. I can therefore give but a brief summary of it without placing the track on the chart.

It is stated only in reference to her position that she was "on the day before the hurricane in Lat.  $17^{\circ} 58'$  North ; Long.  $86^{\circ} 34'$  East, by Chr. steering to the N. E. b. N. and N. East. I take this to have been at noon of the 11th, though the wind is marked on that day as at N. b. E.  $\frac{1}{2}$  E. to N.  $\frac{1}{2}$  E. Bar. 29.60 ; so that the ship could only have been making about an E. N. E. course at the most.

On the 12th Oct.—4 A. M. Bar. 29.56 ; at 7 A. M. 29.50 ; strong breezes N. N. E. Noon reefed foresail and making other preparations. 1 P. M. wind was N. N. E. ; Bar. 29.48 ; and by 5 P. M. N. W. and Bar. 29.46 ; weather very thick with hard rain. 11.30 hove too. Midnight wind south, blowing hard, lost a cutter, Bar. 29.40.

13th Oct.—Daylight wind S. E. ; Bar. 29.34. Heavy gales. 11 A. M. Bar. 29.30 ; hurricane ; lost topmasts Bar. 29.26 ; wind S. E. Noon furious hurricane S. E. Bar. 29.22. P. M. the same awful appearance in the weather, wind S. E. Bar. 29.22. Lost gig and mizenmast. Midnight wind S. E. Bar. 29.26.

14th.—Daylight increasing. 6 A. M. wind S. E. Bar. 29.38 ; noon 29.44. P. M. wind S. S. E. Bar. 29.44.

From this time the gale moderated, but the vessel on the 14th drifted into  $6\frac{1}{2}$  fs.  $23'$  to the E. N. E. of the floating light, and was obliged to anchor, being a perfect wreck. One ship, perhaps the *Hope*, passed her about noon of the 13th with a signal of distress, and another the *Ermouth* foundered at her anchors in sight of her on the night of the 15th,—16th.

*Abridged Log of the Ship FUTTLE ROZACK, Capt. ANDREWS (No. 19 on the Chart), from Calcutta to Judda. Civil Time.*

The ship *Futtle Rozack* left Calcutta very deeply laden but, as will be seen, by the able and scientific management of her commander

in crossing in front of the Cyclone, she sustained no injury except the loss of an old Jolly Boat. Several of the dismasted and foundered vessels left their pilots exactly at the same time, but they seem all to have kept their wind as long as possible, and thus to have just stood into the fatal centre. To this they were no doubt led by the dread of the lee shores of Point Palmiras with an Easterly gale. I trust we shall now be able to offer suggestions, if not to lay down rules, to obviate or diminish the chances of such fatal errors in future.

*11th October.*—P. M. Lower floating light E. b. S. dirty gloomy appearance, afraid of getting a breeze about the Sandheads stood South. Wind East, 4 to 6 knot breeze, to midnight; 5 P. M. weather looking much worse, a deep red glare thrown out by the setting sun. Every appearance for a hurricane; made all preparations. At 8 increasing, at 10 a dark heavy leaden bank of clouds, but appears stationary all round, about  $20^{\circ}$  high. Above it a thin strata of clouds flying with great rapidity from the Northward. Midnight squally with rain Bar. 1 P. M. 29.70; Ther  $84^{\circ}$ ; at 8, 29.70; at 10, 29.65. Force of wind from 5 increasing to 8.

*12th Oct.*—1 A. M. Bar. 29.62; 6 A. M. 29.62; 10 A. M. 29.61; noon 29.61. From midnight very threatening looking weather, wind varying in a strange way from E. N. E. to E. S. E., to 3 A. M. moon and stars about the Zenith beautifully bright, not so much as a circle round the moon, and scarcely any scud was flying during the time the wind was flying about in such an extraordinary way. No doubt now, at 3, that this is a Cyclone; shortened sail to heave to, to allow it to pass, but wind shifting suddenly to N. N. E. kept away before it to get to the S. W. At 10 A. M. heavy-looking, dark purple or red clouds to the S. E. about  $5^{\circ}$  above the horizon, but about the Zenith some occasional light breaks. At 11.15, a sudden lessening of the wind, Barometer fell between 11h. and 12h. only .01. At noon in Lat.  $19^{\circ} 18'$ , mean D. R. and observation; Long. D. R.  $87^{\circ} 45'$ ; a tremendous sea getting up. P. M. dark, fearful-looking weather all round. Course S. W. wind N. N. E. (7), at 4 North (8), at 8 (9), at 9 (10), at 10 N. b. W. and at midnight N. N. W. (11.) At 1 P. M. the dark gloomy weather spoken of in the morning to the S. E. has cleared away, and that is now the only place with a break in it, and there the weather looks quite fine; 9 P. M. scudding under the foresail; thick lurid clouds now all round, except about the Zenith where a circle of about  $15^{\circ}$  in diameter is beautifully clear, but the scud flying past with very great rapidity from the North. Much light summer-looking lightning, only more broad and not so quick, from S. E. to West. At midnight terrific weather, the wind howling like ten thousand large plug holes with the wind blowing through them, and a very bright, but not altogether red appearance to

the East; Bar. at 1 P. M. 29.59; at 3, 29.57; at 5, 29.55; at 6, 29.50; at 9, 29.47; at midnight 29.45; ship running S. W. to 3 P. M., then South, 5 to 7 knots, to midnight.

*13th October.*—Blowing fearfully from N. N. W. (11) with torrents of rain more like hail, but we cannot say if it was so, the atmosphere appears closed in as dark as possible although moonlight; 3 A. M. wind N. W. b. N. (10), 6 A. M. N. W. (7), N. W. b. W. (8), 9 W. N. W. (8) and at 11 W. b. N. (8). At 4 if possible much worse weather in the squalls, lost a Jolly boat. By 8 less wind but so fearful a sea that we cannot haul the ship to the wind yet. Noon more moderate, but the same sea, ship running to the South and S. E. Noon Lat., by Acct.  $17^{\circ} 17'$ ; Long.  $88^{\circ} 5'$ . The Barometer as follows; 1 A. M. 29.48; at 2 to 4 29.42, 29.37, 29.40; at 5, 29.45; at 6, 29.50; at 7, 29.51; at 8, 29.52; at 9, 29.55; at 10, 29.56; at 11, 29.57; and at noon 29.57. P. M. moderating, made a little sail, a dark heavy leaden bank of clouds away to the N. b. W.; a cross confused sea lifting the ship up and then letting her fall as if it would jerk the masts out of her. To midnight wind from West to S. W. and S. W. b. S.; at 10 P. M. heavy squalls with dreadful thunder and lightning. At midnight moderating fast.

*On the 14th Oct.*—The weather became fair. Noon Lat. Obs.  $17^{\circ} 15'$ ; Long.  $88^{\circ} 26'$ .

*On the 18th.*—Picked up the Rustomjee Cowasjee's mainmast in Lat.  $17^{\circ} 58'$ ; Long.  $86^{\circ} 5'$  East.

To this very valuable log Captain Andrew adds, in his remarks in a letter written from Aden, "I do not think we were within the revolving disk till we got the wind at N. N. E. Consequently I do not think by any manœuvre I could have got better weather than I had. I made a sort of diagram at the time and made the track of the Cyclone about N. W. b. W.  $\frac{1}{2}$  W."

#### *At Calcutta.*

There was nothing remarkable in the weather at Calcutta till the 13th October, on which day my notes begin as follows.

*13th October* —4 A. M. Bar. 29.810; Simpiesometer 29.760; at 6 A. M. Bar. 29.810; Simpiesometer 29.76; the sky a dull white haze above, below heavy nimbi and cumulo nimbi with broken light scud flying beneath all. Wind E. b. N. and N. E. in the squalls; squally and then almost calm. Lower scud flying from about E. N. E. the heavy clouds from E. b. S. At  $\frac{1}{2}$  past noon calms and light squalls; Bar. 29.84; Simpiesometer 29.76; Ther.  $82\frac{1}{2}$ . Dark gloomy weather with heavy dark nimbi, cumuli and strata, moving at a moderate





rate\* from the N. E.; drizzling and light rain. The heaviest masses of clouds to the S. E. At 4 P. M. Bar. 29.79; Simp. 29.70; Ther.  $81\frac{1}{2}$ ; fresh breezes at times from N. E. but not constant. At 7h. P. M. Bar. 29.79; Simp. 29.75; Ther.  $82^{\circ}$ . Squalls, rain and some little moaning wind from the N. E. Sky a dull white haze with strata, &c. as at noon and 4 P. M., but fewer moving clouds and those slower.

14th Oct.—9 A. M. Bar. 29.80; Simp. 29.73; Ther.  $81^{\circ}$ . Alternate squalls with heavy rain and breaks in the clouds; calm with appearances of clearing up. Wind N. E. scud from about East moving fast at times. P. M. alternate squalls and calms with distant thunder, wind hauling to the Eastward and the scud from S. E. and E. S. E.

15th Oct.—During the night rain, blowing fresh in squalls S. Easterly. A. M. squalls with fresh gale at times from S. East; heavy banks to S. E. and South; scud from S. S. W. At  $7\frac{1}{2}$  A. M. Bar. 29.76; Simp. 29.70; Ther.  $82^{\circ}$ . 10 A. M. Bar. 29.83; Simp. 29.72; Ther.  $82\frac{1}{4}^{\circ}$ . Moderate breezes, and then almost calm, with heavy puffs at times; wind S. S. W. to South, dark gloomy weather. At 0.30 P. M. Bar. 29.80; Simp. 29.72. The  $82\frac{1}{4}$  light breezes.

After this time the weather gradually becoming fine.

\* Taking these to have been influenced by the vortex this is what should occur from their great distance (205 miles at noon) from the centre.

[To be continued.]

**PROCEEDINGS**  
**OF THE**  
**ASIATIC SOCIETY OF BENGAL**

**FOR AUGUST, 1849.**

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At a meeting of the Asiatic Society held on Wednesday, the 1st of August, 1849.

Dr. J. McCLELLAND in the chair.

The proceedings of the former meeting were read and confirmed, and the accounts and vouchers of the preceding month were laid upon the table as usual.

The following gentlemen who had been proposed and seconded at the last meeting, were ballotted for and duly elected.

*Arthur Grote, Esq. B. C. S.*

*Doctor Martin.*

Candidate for election at the September meeting, viz. : Raja Pratap-chandra Singha.

*Babu Rajendra Dutto*, proposed by F. E. Hall, Esq. seconded by J. W. Laidlay.

Read letters—

From Captain J. D. Cunningham, Engineers, forwarding a paper “On the Embankments of rivers, and on the Nature of overflowing rivers in diluvial plains.”

From Dr. Harwitz, Berlin, proposing an exchange of works, published by F. Duemmler in Berlin with those of the Society, and forwards a list of Sanskrit works published by F. Duemmler. Referred to the Oriental Section.

From John Barlow, Esq. Secy. Royal Institution of Great Britain, acknowledging the receipt of the Society's Journal.

From F. E. Hall, Esq. to publish the *Bhakta Mala* in the *Bibliotheca Indica*. Referred to the Oriental Section.



From the same requesting to be allowed to take with him to Mofussil, 10 or 12 Persian works, for reference, and some other Hindu Books.

From Major Madden, forwarding Supplementary Notes to the Turae and outer mountains of Kumaoon.

From the Secretary to the Bombay Geographical Society, forwarding a complete set of the translation of the Society, and requesting an exchange of publication to be established between them.

Proposed by Mr. Jackson, and seconded by Capt. Forbes, that all proposals of this kind from individuals or Society, for the exchange of books be in the first place laid before the Council.

From Dr. Roer, proposing Mr. Ariel, Secretary to the Government of Pondichery, to be elected a corresponding member of the Asiatic Society, seconded by Mr. H. Alexander.

From the same, proposing the printing of certain Upanishads in the *Bibliotheca Indica*.

The Zoological and Geological Curators having read their respective reports.

The President stated that he had the pleasure of laying before the meeting, the Catalogue of the Birds in the Society's Museum recently prepared by Mr. Blyth.

After some remarks upon that work, Mr. Welby Jackson suggested that a copy be circulated to the Council of the Society, that its price and the number of copies to be placed at the disposal of the author to be determined upon.

The ordinary business of the evening being concluded, the President called the attention of the meeting to the financial position of the Society, read the subjoined report upon that subject from the Council.

Some discussion having arisen upon the various items of retrenchment suggested by the Council, it was proposed by Babu Ramgopaul Ghose, seconded by Mr. Mitchell, and carried—

"That the Report of the Council be received with thanks, but that its consideration be postponed till the next monthly meeting, and that in the meantime, it should be circulated to resident members along with the accounts now laid on the tables."

The meeting then adjourned.

J. McCLELLAND,

J. W. LAIDLAY.

**FINANCIAL REPORT.**

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The subjoined Report of the Council of the Asiatic Society is printed for circulation among the Members, in pursuance of a resolution passed at the Meeting of the Society, 1st August, 1849.

J. W. LAIDLAY,  
*V. P. and Sec.*

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The Council of the Asiatic Society having anxiously considered a statement of the financial position of the Society submitted by the Secretaries, deem it their duty to recommend considerable reductions in the Society's present expenditure, the adoption of which the Council believe cannot be postponed without exposing the Society to the risk of falling into a state of serious, if not ruinous, embarrassment.

On a careful examination of the accounts, it appears that the present liabilities of the Society exceed the amount of its available assets by Rs. 2,557 6 7; that whilst on the one hand sums, which though nominally due to the Society are supposed to be irrecoverable, have been carefully excluded from the list of available assets, and the list of liabilities includes some sums not likely to be presently claimed, and others which represent demands that in their nature are extraordinary and unlikely to recur; yet on the other hand the liabilities which now exist are certain in amount, whilst the outstanding assets when actually realised may fall short even of the amount now assumed to be capable of realization. It further appears, and this is a fact which the Council desire to impress particularly upon the Society, that if the monthly income and expenditure of the Society remain unaltered, its embarrassment must increase, because the present ordinary expenditure exceeds the present income by the sum of Rs. 179 6 0 per mensem. This is of course a state of things which none can wish to continue; but the Council beg further to remark that in their judgment it is not merely by limiting the ordinary expenditure of the Society to the amount of its income, or even by the discharge of its present debts that the Society's finances can be placed upon a satisfactory footing. Provision should be made for the purchase of books, the occasional repairs or improvement of the premises, the preservation and extension of our collections, and the other extraordinary demands

to which this, like every other Society of similar constitution, has hitherto been, and is likely to continue subject.

The Council regret that some of the reductions which they recommend will press heavily upon individual officers of the Society; a consequence which the Council would willingly have avoided, had they seen any other mode of extricating the Society from its difficulties.

In proposing such reductions they desire to be understood as expressing, not any opinion that the officers who will be affected are now too highly remunerated with reference to their attainments, but a deliberate conviction that the affairs of the Society must henceforth be conducted upon a more economical scale, and that they may be efficiently conducted notwithstanding the reductions proposed.

The following are the principal reductions recommended by the Council.

1st. They recommend that the European Accountant at present employed by the Secretaries be hereafter dispensed with. This will effect a saving of Rs. 60 per mensem. The Council are by no means insensible to the importance of providing for the due keeping and audit of the Society's accounts. But the native writer attached to the Secretary's office ought to be, and the Council believe is, fully competent to keep the accounts; and the Council believe that a far more effectual and satisfactory system of audit than any which has yet been provided, would be found in the appointment by the Society of three or more of its members to act as a Finance Committee. The Council think that the duties of such a Committee need not be restricted to the mere auditing of the Secretaries' accounts, but that in every case in which the Society is called upon to make a vote of money, it might usefully refer to the Committee to report whether, having regard to the then state of the Society's finances, such an expenditure would be safe or prudent. This would in no degree affect the undoubted privilege of the Society at large to determine to what objects its money should be applied, whilst it would afford a safeguard against hasty and improvident votes by which the resources of the Society are liable to be anticipated. A further, though slight reduction is proposed in the Secretaries' office by the removal, of one of the peons at present employed there.

2nd. The Zoological department as at present constituted, is a

heavy burthen upon the Society's finances. Over and above the Curator's salary of Rs. 250, and the allowance for collecting and preserving specimens received from Government, the Society expends in this department out of its own resources about Rs. 142 8. The establishment, independently of the Curator, consists of four Taxidermists or assistants, and two Carpenters, besides Durwans and Ferashees, who ought properly to be included in the general establishment of the Society. The Society has further, pursuant to a resolution of the 21st day of Oct. 1845, to pay the sum of Rs. 40 per mensem as a house allowance to the Curator. The Contingent bill of the department more than exhausts the Government monthly allowance of Rs. 50.

The Council consider it essential for the well-being of the Society under existing circumstances to reduce the expenditure under this head to an amount exceeding as little as possible that of the Government allowances. They propose therefore that the establishment be reduced to a Curator, and two Taxidermists at Rs. 30 each ; that one of those Taxidermists be paid out of the Government allowance of Rs. 50. per mensem ; that the contingencies, including carpenter's work (the present carpenters being no longer kept on the fixed establishment) be limited as far as possible to the balance of that sum. They further propose that the house allowance to the Curator, a charge which the funds of the Society are no longer adequate to bear, be discontinued, but that his reduction do not take effect until the 1st of October next.

3rd. With respect to the Library, the Council recommend that the fixed establishment consist merely of one Librarian at a monthly salary of Co.'s Rs. 50, who is to have the charge of all the books whether European or Oriental. Of this sum the Council consider that Co.'s Rs. 25 should be paid by the Oriental Fund, which has hitherto borne the charge of Rs. 30 per mensem, for the Moulvie who took care of the Arabic and Persian works. They recommend that the services of the Moulvie in this respect be discontinued, and that for the future no Moulvie or Pundit form part of the fixed establishment of the Society, but the cost of employing such persons, if their services are required for the purposes of collation or copying MSS., or of correcting the press, be treated as contingent, and defrayed accordingly out of the Oriental Fund. It is proposed that this reduction of

the present Librarian's salary should not take effect until the 1st of October. The Duffries and other menial servants to be employed in the Library, form part of the general establishment of servants now proposed, and some reduction in this respect will also be effected.

The general establishment of servants now proposed will be found in the paper marked (No. 6). Several useless servants will be dispensed with, and the whole expence of the establishment now proposed will be Rs. 781 8 0, whilst the expences of the present establishment are Rs. 1089 8 0, and thus if the reductions now proposed be adopted, the saving to the Society will be Rs. 338 0 0\* per mensem.

For the elucidation, and in confirmation of the foregoing statement, the Council lay upon the table of the Society, the following accounts and papers, viz :

No. 1, Statement of the Debts and Dependencies of the Asiatic Society.

No. 2, Statement of the average monthly Income and Expenditure of the Asiatic Society.

No. 3, Statement of the monthly Expenditure of the Asiatic Society, as proposed by the Council.

No. 4, Changes among the Members from death, withdrawal, &c.

No. 5, List of Members of the Asiatic Society of Bengal.

No. 6, Revised Scheme of an Establishment of the Asiatic Society, as proposed by the Council.

One of the heaviest items in the Society's expenditure is the outlay for the publication of the Journal. The council would recommend no reduction on this head, which might interfere with the dissemination of this work. On full consideration of the subject however, they conceive that the number of copies printed may safely be reduced to 400, and without laying down any definite or inviolable rule for the conduct of the work, they recommend that for the future, the Secretaries limit as far as possible, the outlay on the work to Rs. 250 per month.

If this can be effected, the saving to the Society, by means of these General reductions, will be increased to Rs. 528.

|                                                              |     |
|--------------------------------------------------------------|-----|
| * Saving on account Establishment, Rs. ....                  | 308 |
| Ditto ditto Contingencies in the Zoological Department ..... | 30  |

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Co.'s Rs. 338

*Statement of the Old and Revised Establishment of the Asiatic Society, shewing in detail the Items of Saving, per month, to the Society, and to Government Allowances.*

| OLD ESTABLISHMENT.               |  |                       |                       | REVISED ESTABLISHMENT.           |  |                       |                       | SAVING.                                           |  |                     |                     | REMARKS.                                                                                                         |
|----------------------------------|--|-----------------------|-----------------------|----------------------------------|--|-----------------------|-----------------------|---------------------------------------------------|--|---------------------|---------------------|------------------------------------------------------------------------------------------------------------------|
| Designation.                     |  | Salaries per month.   |                       | Designation.                     |  | Salaries per month.   |                       | Items of.                                         |  | Saving per month.   |                     |                                                                                                                  |
|                                  |  | From Socie-ty's fund. | From Govt. allowance. |                                  |  | From Socie-ty's fund. | From Govt. allowance. |                                                   |  | To Socie-ty's fund. | To Govt. allowance. |                                                                                                                  |
| Zoological Curator-Salary,       |  | ..                    | 250                   | Zoological Curator-Salary,       |  | ..                    | 250                   | .....                                             |  | ..                  | ..                  | Paid by Government.                                                                                              |
| Ditto House rent,.....           |  | 40                    | ..                    | .....                            |  | ..                    | ..                    | Allowance of House rent to Zoological curator, .. |  | 40                  | ..                  | {<br>Rs. 30 to be paid out of the 50 Rs. allowed by Govt. for prep. specimens of Nat. Hist.                      |
| 1 Assistant to Ditto,.....       |  | 20                    | ..                    | .....                            |  | 80                    | ..                    | Assistant to ditto, .....                         |  | 20                  | ..                  |                                                                                                                  |
| 3 Taxidermists,.....             |  | 75                    | ..                    | 1 Taxidermist, .....             |  | ..                    | ..                    | 2 Taxidermists, .....                             |  | 45                  | ..                  |                                                                                                                  |
|                                  |  |                       |                       | 1 Ditto, .....                   |  | ..                    | 30                    | .....                                             |  | ..                  | ..                  |                                                                                                                  |
| 2 Carpenters,.....               |  | 13                    | ..                    | .....                            |  | ..                    | ..                    | 2 Carpenters, .....                               |  | 13                  | ..                  | {<br>Paid by Government.<br>This Establishment is sanctioned by Govt. who allow 64 Rs. for it and contingencies. |
| Mus. Eco: GEOLY. CURATOR-SALARY, |  | ..                    | 250                   | Mus. Eco. GEOLY. CURATOR-SALARY, |  | ..                    | 250                   | .....                                             |  | ..                  | ..                  |                                                                                                                  |
| 1 Writer, .....                  |  | ..                    | 16                    | 1 Writer, .....                  |  | ..                    | 16                    | .....                                             |  | ..                  | ..                  |                                                                                                                  |
| 1 Carpenter,.....                |  | ..                    | 8                     | 1 Carpenter, .....               |  | ..                    | 8                     | .....                                             |  | ..                  | ..                  |                                                                                                                  |
| 1 Peon, .....                    |  | ..                    | 5                     | 1 Peon, .....                    |  | ..                    | 5                     | .....                                             |  | ..                  | ..                  |                                                                                                                  |
| 1 Pankha boy, .....              |  | ..                    | 2                     | .....                            |  | ..                    | ..                    | 1 Pankha boy, .....                               |  | ..                  | 2                   |                                                                                                                  |

|                            |       |                         |       |       |                                          |     |    |                                                                                                |
|----------------------------|-------|-------------------------|-------|-------|------------------------------------------|-----|----|------------------------------------------------------------------------------------------------|
| Librarian's Salary, .....  | 100   | 1 Librarian, .....      | { 25  | ..    | Part of Librarian's pay, ...             | 76  | 35 | Ra. 25 to be paid to the Librarian out of the 30 Rs. allowed to Mouvie from the Oriental Fund. |
| Mouvie, Ditto, .....       | ..    | To Ditto, .....         | { ..  | 26 }  | Saving from Mouvie and Fund's pay, ..... | }   | .. |                                                                                                |
| Pundit, Ditto, .....       | ..    | ..                      | ..    | ..    | ..                                       | ..  | .. |                                                                                                |
| House Sergeant, Ditto, ..  | 40    | 1 House Sergeant, ..... | 40    | ..    | ..                                       | ..  | .. | Paid from the Oriental Fund.                                                                   |
| 1 Dufry, .....             | 8     | 1 Dufry, .....          | 8     | 6     | ..                                       | ..  | .. |                                                                                                |
| 1 Ditto, .....             | ..    | 1 Ditto, .....          | ..    | ..    | ..                                       | ..  | .. |                                                                                                |
| SECRETARY'S OFFICE.        |       | SECRETARY'S OFFICE.     |       |       |                                          |     |    |                                                                                                |
| Accountant, .....          | 60    | Writer, .....           | ..    | ..    | Accountant, .....                        | 60  | .. |                                                                                                |
| Writer, .....              | 20    | Sircar, .....           | 20    | ..    | Dufry, .....                             | 3   | .. |                                                                                                |
| Sircar, .....              | 6     | ..                      | 6     | ..    | 1 Peon, .....                            | 6   | .. |                                                                                                |
| Dufry, .....               | 3     | ..                      | ..    | ..    | 2 Durwans, .....                         | 12  | .. |                                                                                                |
| 4 Peons, .....             | 22    | 3 Peons, .....          | 16    | ..    | 1 Chowkedar, .....                       | 6   | .. |                                                                                                |
| 3 Durwans, .....           | 18    | 1 Durwan, .....         | 6     | ..    | 3 Ferashes, .....                        | 17  | .. |                                                                                                |
| 2 Chowkedars, .....        | 12    | 1 Chowkedar, .....      | 6     | ..    | ..                                       | ..  | .. |                                                                                                |
| 6 Ferashes, .....          | 35    | 3 Bearers, .....        | 18    | ..    | 1 Males, .....                           | 4   | .. |                                                                                                |
| 1 Ditto, .....             | ..    | 1 Bearer, .....         | ..    | 6     | ..                                       | ..  | .. | Paid from the Oriental Fund.                                                                   |
| 1 Sweeper, .....           | 5     | 1 Sweeper, .....        | 5     | ..    | ..                                       | ..  | .. |                                                                                                |
| 1 Bhisty, .....            | 3     | 1 Bhisty, .....         | 3     | ..    | ..                                       | ..  | .. |                                                                                                |
| Males, .....               | 4     | ..                      | ..    | ..    | ..                                       | ..  | .. |                                                                                                |
| 1 Sicklegar, .....         | 2     | 1 Sicklegar, .....      | 2     | ..    | ..                                       | ..  | .. |                                                                                                |
| Co.'s Ra., ..              | 486 8 | Co.'s Ra., ..           | 185 8 | 596 0 | Co.'s Ra., ..                            | 301 | 37 | Including the saving on acct. contingencies in the Zoological Dept.                            |
| 486 8                      |       | 185 8                   |       |       | 301 0                                    |     |    |                                                                                                |
| 603 0                      |       | 596 0                   |       |       | 37 0                                     |     |    |                                                                                                |
| Original Est. Ra. 1,069 8  |       | Co.'s Ra., ..           | 185 8 | 596 0 | Co.'s Ra., ..                            | 301 | 37 |                                                                                                |
| Revised Do. 781 8          |       | ..                      | ..    | ..    | ..                                       | ..  | .. |                                                                                                |
| Saving in all } Rs. 338 0  |       | ..                      | ..    | ..    | ..                                       | ..  | .. |                                                                                                |
| including contingencies, } |       | ..                      | ..    | ..    | ..                                       | ..  | .. |                                                                                                |

J. W. LAIDLAY, Secretary.







| Observations made at 2h. 40m. |      |      |      |          |               |                |              |      |      | Minimum Pressure observed at 4 p. m. |               |        |       |      |                |              |                 |      |      | Observations made at sun set. |       |       |       |                                  |      |                    |    |           |    | Ram Gauges.  |   |
|-------------------------------|------|------|------|----------|---------------|----------------|--------------|------|------|--------------------------------------|---------------|--------|-------|------|----------------|--------------|-----------------|------|------|-------------------------------|-------|-------|-------|----------------------------------|------|--------------------|----|-----------|----|--------------|---|
| Temperature.                  |      |      |      | Wind.    |               | Aspect of Sky. | Bar. red. to |      |      |                                      | Temperature.  |        | Wind. |      | Aspect of Sky. | Bar. red. to |                 |      |      | Temperature.                  |       | Wind. |       | Maximum and Minimum Thermometer. |      | Max. in sun's ray. |    | Feet, 40. |    | Feet, Lower. |   |
| Inches                        | °    | °    | °    | °        | °             |                | °            | °    | °    | °                                    | °             | °      | °     | °    |                | °            | °               | °    | °    | °                             | °     | °     | °     | °                                | °    | °                  | °  | °         | °  | °            | ° |
| 29.314                        | 87.0 | 86.4 | 82.2 | N. E.    | Cloudy        | 29.280         | 93.2         | 88.5 | 82.0 | N. E.                                | Nimbi.        | 29.305 | 84.0  | 83.7 | 80.4           | E.           | Cloudy          | 90.3 | 85.9 | 81.4                          | 100.4 | °     | Inch. | 0.58                             | 0.60 | 1                  |    |           |    |              |   |
| .419                          | 84.0 | 82.0 | 79.3 | S. E.    | Drizzly       | .413           | 85.0         | 84.5 | 80.8 | S. E.                                | Cumulo strati | .434   | 81.8  | 81.3 | 78.9           | S.           | Ditto           | 89.8 | 84.8 | 79.8                          | 107.0 | °     | Inch. | 0.54                             | 0.62 | 2                  |    |           |    |              |   |
| .469                          | 85.0 | 85.0 | 80.0 | S. S. W. | Cumulo strati | .447           | 85.0         | 84.5 | 79.5 | S. ship.                             | Cloudy.       | .465   | 85.1  | 81.8 | 77.9           | S. S. W.     | Cirro strati    | 88.3 | 83.2 | 78.0                          | 100.2 | °     | Inch. | 0.05                             | 0.08 | 3                  |    |           |    |              |   |
| .457                          | 88.6 | 88.0 | 80.6 | S. W.    | Ditto         | .444           | 88.2         | 87.2 | 80.0 | S. W.                                | Cumulo strati | .435   | 84.0  | 83.9 | 79.9           | S. E.        | Cloudy          | 92.5 | 86.7 | 81.6                          | 114.0 | °     | Inch. | 0.26                             | 0.26 | 4                  |    |           |    |              |   |
| .433                          | 90.8 | 89.0 | 82.3 | E.       | Cloudy.       | .430           | 86.2         | 84.2 | 79.8 | S. E.                                | Cumulo strati | .430   | 84.5  | 84.8 | 79.9           | S.           | Cloudy to south | 91.7 | 86.4 | 80.3                          | 108.2 | °     | Inch. | 0.24                             | 0.24 | 5                  |    |           |    |              |   |
| .424                          | 92.8 | 91.0 | 81.7 | E.       | Cumulo strati | .412           | 86.3         | 84.6 | 81.9 | S. S. E.                             | Cloudy        | .505   | 80.8  | 80.8 | 78.0           | S.           | Cloudy          | 89.5 | 84.9 | 80.3                          | 103.8 | °     | Inch. | 0.42                             | 0.44 | 6                  |    |           |    |              |   |
| .477                          | 84.0 | 82.5 | 80.0 | S. E.    | Drizzly       | .467           | 83.4         | 82.5 | 80.0 | S. E.                                | Cloudy        | .560   | 83.2  | 82.4 | 79.7           | S.           | Cirro cumuli    | 86.8 | 82.5 | 78.2                          | 105.9 | °     | Inch. | 0.14                             | 0.20 | 7                  |    |           |    |              |   |
| .579                          | 86.2 | 85.7 | 78.3 | S. S. W. | Cloudy        | .556           | 87.4         | 86.3 | 80.8 | S. W.                                | Cumulo strati | .593   | 82.2  | 82.4 | 79.0           | S.           | Cumulo strati   | 88.8 | 83.3 | 77.8                          | 102.9 | °     | Inch. | 0.34                             | 0.60 | 9                  |    |           |    |              |   |
| .575                          | 86.2 | 85.3 | 79.9 | S. E.    | Cumulo strati | .659           | 84.6         | 84.6 | 80.6 | S. W.                                | Ditto         | .663   | 83.3  | 83.4 | 80.6           | S. W.        | Zenith clear    | 88.2 | 84.0 | 79.8                          | 103.0 | °     | Inch. | 0.46                             | 0.54 | 10                 |    |           |    |              |   |
| .664                          | 84.9 | 83.8 | 81.0 | S. S. W. | Drizzly       | ..             | ..           | ..   | ..   | ..                                   | ..            | ..     | ..    | ..   | ..             | ..           | ..              | ..   | ..   | ..                            | ..    | ..    | ..    | ..                               | ..   | ..                 | .. | ..        | .. | ..           |   |
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| ..                            | ..   | ..   | ..   | ..       | ..            | ..             | ..           | ..   | ..   | ..                                   | ..            | ..     | ..    | ..   | ..             | ..           | ..              | ..   | ..   | ..                            | ..    | ..    | ..    | ..                               | ..   | ..                 | .. | ..        | .. | ..           |   |
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# JOURNAL

OF THE

# ASIATIC SOCIETY.

SEPTEMBER, 1849.

*An Eighteenth Memoir on the Law of Storms in India, being the Cyclone of 12th to 14th October 1848, in the Bay of Bengal. By HENRY PIDDINGTON, President of Marine Courts.*

[Throughout this paper the word CYCLONE designates a Circular Storm.—H. P.]

(Concluded from page 857.)

I proceed now to give in a Tabular form the winds and weather experienced by the various ships and stations during the Cyclone, at noon on different days, from which its gradually reaching and strength at the spot will be seen, and at the same time many of the effects preceeding the onset of the bad weather, as contrasted with those actually undergone by other vessels at the same time, at no great distance from them.

*Tabular View of the Winds and Weather for the Cyclone of Oct. 1848, in the Bay of Bengal at Noon.*

| Date.               | No. | Name of Ship or Station. | Lat. N. | Long. East. | Winds and Weather.                                    | Bar.  | Simp. | Ther. | Remarks.                                                  |
|---------------------|-----|--------------------------|---------|-------------|-------------------------------------------------------|-------|-------|-------|-----------------------------------------------------------|
| 1848<br>9th<br>Oct. | 1   | Joven Corinna,           | 14°47'  | 91°34'      | E.N.E.; Noon East, strong gales.                      | 29.65 | 29.10 | 85°   | Heavy swell from E. S. E.; 8 p. m. to mid-night moderate. |
|                     |     | At KYOOK PHYOO.          | 19.26   | 93.34       | Light breezes N. E. to E. S.E. and hot sultry weather | 29.90 |       | 87°   | Sky clear.                                                |

| <i>Date.</i>       | <i>No.</i> | <i>Name of Ship or Station.</i> | <i>Lat. N.</i> | <i>Long. East.</i> | <i>Winds and Weather.</i>                                                                                                            | <i>Bar.</i> | <i>Simp.</i>       | <i>Ther.</i> | <i>Remarks.</i>                                                              |
|--------------------|------------|---------------------------------|----------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------|--------------|------------------------------------------------------------------------------|
| 1848.<br>10th Oct. | 1          | Joven Cortina.                  | 15° 13'        | 93. 48.            | S. b. W. to S. S. W. and S., squalls to S. W. rain and sea.                                                                          | ....        | 8 A. M.<br>29. 84. | ....         | At midnight in 50 fa.                                                        |
|                    | 2          | Brig Teak.                      | 15. 37.        | 92. 29.            | 4 A. M. nearly calm; 8 steady S. S. E. Noon South; 2 P. M. strong squall S. W.; 3, W. S. W. strong gale and fierce squalls, 6, S. W. | 29. 67.     | 29. 10.            | 85°.         | At 8 moderating a little, but at midnight as before; dense strata and nimbl. |
|                    | 3          | Enigma.                         | 15. 17.        | 93. 10.            | Fresh gale S. S. W. at Noon, and South P. M.; 4 P. M. S. S. W. and at 10 S. W.                                                       | ....        | ....               | ....         | Ship running to the N. W.                                                    |
|                    |            | At KROOK PHUO.                  | 19. 26.        | 93. 34.            | Blowing fresh E. S. E. and cloudy.                                                                                                   | 29. 88.     | ....               | 86           | ....                                                                         |
|                    | 4          | Eagle.                          | 19. 44.        | 90. 35.            | Steady E. N. E. breeze and fine. Wind Easterly till midnight. Sunset smart gales, E. b. N.                                           | 29. 30.     | ....               | 84           | ....                                                                         |
|                    | 5          | Ararat.                         | 15. 41.        | 92. 45.            | Squally and variable S. S. W.                                                                                                        | ....        | ....               | ....         | Studding-sails set.                                                          |
|                    | 6          | Flora McDonald.                 | 20. 34.        | 92. 15.            | Light breezes E. N. E. and cloudy; P. M. calm and cloudy 9 P. M. E. N. E. strong gales and cloudy.                                   | ....        | ....               | ....         | At anchor till 9 P. M. off St. Martin's Island.                              |

| 10th Oct. | 7  | Barham.        | 15°. 40'. 86°. 15'. | P. M. Fresh unsteady breeze Northerly; and squally to hard squalls.                                                     | 29. 72.                       | 29. 45. | 84° | Heavy swell from the Eastward; making preparations for bad weather. Midnight Bar. 29. 65; Simp. 29. 36. |
|-----------|----|----------------|---------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------|-----|---------------------------------------------------------------------------------------------------------|
|           | 8  | Wellesley.     | 13. 40. 83. 45.     | N. W. y. breeze.                                                                                                        | ...                           | ...     | ... | ...                                                                                                     |
|           | 12 | Camperdown.    | 20. 17. 89. 03.     | Light airs and calms.                                                                                                   | ...                           | ...     | ... | Noon Floating Light N. E. b. N. 50 miles.                                                               |
|           | 17 | John Hepburn.  | 19. 28. 88. 33.     | Winds variable and light; East to E. N. E.                                                                              | 29. 67.                       | ...     | 87  | P. M. moderate; sunset weather becoming unsettled from the Eastward; swell from the S. E.               |
|           | 18 | Easurain.      | 21. 6. 86. 16.      | Light airs S. E.; mid-night fresh breezes E. b. N. and fine.                                                            | ...                           | ...     | ... | ....                                                                                                    |
| 11th Oct. | 1  | Brig Teak.     | 15. 19. 91. 26.     | South to 6 A. M. then S. S. E. throughout with heavy squalls.                                                           | 29. 65.<br>2 P. M.<br>29. 60. | ...     | 81  | Running to the W. N. W. 5 ks. to 9 knots. Midnight strong gale and high sea.                            |
|           | 2  | Joven Corinna. | 15. 21. 94. 20.     | A. M. S. S. W. fierce gale and fearful squalls, moderating to Noon, when South; P. M. S. S. E. increasing to mid-night. | 29. 70.                       | 29. 17. | 84  | Noon only fresh winds and cloudy; midnight dense strata from S. E.                                      |

| Date.             | No. | Name of Ship or Station. | Lat. N. | Long. East. | Winds and Weather.                                                                             | Bar.    | Simp. | Ther. | Remarks.                                                                                                                                               |
|-------------------|-----|--------------------------|---------|-------------|------------------------------------------------------------------------------------------------|---------|-------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1848.<br>11th Oct | 3   | Enigma.                  | 17° 24' | 90° 55'     | Strong gales S. S. E. at 8h S. E.; at Noon drizzling rain and sea getting up.                  | ....    | ....  | ....  | P. M. a tremendous squall, S. E.                                                                                                                       |
|                   |     | At KYOOK PHYOO.          | 19. 26. | 93. 34.     | Blowing fresh, East to E. S. E. light rain and squally appearances.                            | 29. 84. | ....  | 81    | ....                                                                                                                                                   |
|                   |     | At AKYAB.                | 20. 08. | 92. 55.     | Wild aspect, cloudy thunder, lightning and rain; wind from North and East; A. M. wind E. S. E. | 29. 60. | ....  | ....  | ....                                                                                                                                                   |
|                   | 4   | Eagle.                   | 19. 6.  | 91. 15.     | A. M. East to E. N. E. 8 A. M. E. S. E. mid-night E. S. E.                                     | 29. 15. | ....  | ....  | P. M. moderate, with a heavy sea from the Eastward; 4 P. M. smart gales increasing throughout the night to a heavy gale E. S. E. Bar. mid-night 29.00. |
|                   | 5   | Ararat.                  | 17. 20. | 91. 37.     | Fresh breeze S. E. and cloudy; P. M. cloudy and puffy.                                         | 29. 81. | ....  | ....  | Running 8 knots to the N. W. b. N.; at 5h. 30 under close reef.                                                                                        |
|                   | 6   | Flora McDonald.          | 19. 56. | 92. 0.      | A. M. E. S. E. increasing to a strong gale and heavy sea at Noon, when wind E. E. P. M.        | ....    | ....  | ....  | Gale, rain and squalls in heavy gusts to mid-night.                                                                                                    |

| 11th Oct. | 7  | Barham.             | 16° 22'. | 87° 16'. | A. M. very hard squalls, W. N. W. Noon variable P. M. S. W. S. light air and calms 6h. N. W. 9h W. N. W. | 29. 68.             | 29. 38. | 84°  | 7 A. M. weather moderating; 6 P. M. hard squall from N. W. high sea, much lightning at midnight.                                        |
|-----------|----|---------------------|----------|----------|----------------------------------------------------------------------------------------------------------|---------------------|---------|------|-----------------------------------------------------------------------------------------------------------------------------------------|
|           | 8  | Walsley.            | 15. 15.  | 86. 8.   | N. W. to W. N. W. P. M. arched squalls from N. E.                                                        | ....                | ....    | .... | Dark lurid appearance to the Eastward, getting more dense, and hot stifling feeling towards Noon. Clouds in dark masses flying to West. |
|           | 9  | Sea Park.           | 16. 57.  | 90. 02.  | Wind variable S. S. W. to S. E. and East, and fine; P. M. East, veering to N. E. weather looking dirty.  | 10 A. M.<br>29. 70. | 29. 30. | .... | 5 P. M. Bar. 29. 60; Simp. 29. 20; Bar. falling, variable to midnight.                                                                  |
|           | 10 | Asiatic.            | 20. 7.   | 86. 56.  | A. M. Light variable breezes N. N. W. and East; Noon squally from North.                                 | 8 P. M.<br>29. 60.  | ....    | .... | 8 P. M. increasing. Ship standing to the Eastward.                                                                                      |
|           | 11 | Sir Robt. Seppings. | 18. 55.  | 86. 16.  | To Noon fresh Northerly and N. N. E. breeze; midnight strong Northerly breezes.                          | 29. 90.             | ....    | 89   | Heavy head sea throughout; midnight much lightning to the Eastward. Ship standing to the Eastward throughout.                           |
|           | 12 | Camperdown.         | 20. 32.  | ....     | Squally, rain and light airs and calms.                                                                  | ....                | ....    | .... | Ship standing to the S. E. A cross sea but no appearance of bad weather.                                                                |

| Date.              | No. | Name of Ship or Station | Lat. N. | Long. East. | Winds and Weather.                                                                                            | Bar.    | Simp. | Ther. | Remarks.                                                                                                             |
|--------------------|-----|-------------------------|---------|-------------|---------------------------------------------------------------------------------------------------------------|---------|-------|-------|----------------------------------------------------------------------------------------------------------------------|
| 1848.<br>11th Oct. | 13  | Collingwood.            | 16° 21' | 88° 38'     | Fine weather, wind from N. East 4 and 5 knot breezes P. M. cloudy and variable from N. and N. E. to midnight. | 29. 67. | ....  | 83°   | Ship standing to the N. W.                                                                                           |
|                    | 14  | Edmundsbury.            | ....    | ....        | Variable from E. S. E. 6.30 E. N. E. increasing.                                                              | ....    | ....  | ....  | Anchored with Pilot on board; at 6.30 stood to sea with a strong breeze at E. N. E. increasing; midnight Bar. 29.65. |
|                    | 15  | Framjee Cowasjee.       | ....    | ....        | P. M. wind E. N. E. and light to midnight.                                                                    | ....    | ....  | ....  | Received a Pilot at 7. 30 A. M. Noon abreast the Floating Light.                                                     |
|                    |     | At BALASORE.            | 21. 28. | 87. 12.     | S. E. to N. W. Lightening to S. E. East and West, rain from S. E. with heavy clouds.                          | 29. 68. | ....  | 83    | Bar. falling; from 29. 74 to 29. 72.                                                                                 |
|                    | 16  | Washington Alston.      | 20. 15. | 88. 36.     | P. M. squally and rain E. N. E. to E. S. E. and a large sea. Midnight moderate.                               | ....    | ....  | ....  | Ship standing to the S. S. E.                                                                                        |
|                    | 17  | John Hepburn.           | 18. 18. | 89. 06.     | Light winds and equally E. N. E. P. M. cloudy threatening E. N. E. to S. E.                                   | 29. 61. | ....  | 86.   | Heavy swell from the S. E. Bar. 29.50; midnight dark cloudy weather.                                                 |



| 18        | Baromet.                                          | 19°. 36'; 87°. 38. | 3 A. M. E. b. S. 7<br>N. N. E. to Noon when<br>squally.                                                                              | ....                                                        | ....    | ....           | ....                                                                                                                                              |
|-----------|---------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|---------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 19        | Futtle Rosack.                                    | ....               | P. M. wind East.                                                                                                                     | 1 P. M.<br>29. 70.                                          | ....    | 84             | P. M. Lower F. L. E. $\frac{1}{2}$<br>S. 5 weather looking bad.                                                                                   |
|           |                                                   |                    | H.                                                                                                                                   | Vessels.                                                    | ....    |                |                                                                                                                                                   |
|           | H. C. P. V. Fame.                                 |                    | Wind S. E. to East<br>Noon; P. M. Easterly,<br>strong breeze and heavy<br>rain.                                                      | 8 A. M.<br>3. 7.<br>Noon<br>30. 1.<br>4 P. M.<br>29. 95.    | ....    | ....           | Noon at anchor P.<br>L. V. N. E. by E. $\frac{1}{2}$ E.                                                                                           |
|           | H. C. P. V. Colle-<br>roon, Eastern Chan-<br>nel. | ....               | A. M. East to S. E.<br>7 P. M. strong Easterly<br>breezes and clear wea-<br>ther.                                                    | 8 A. M.<br>29. 86.<br>Noon<br>29. 84.<br>8 P. M.<br>29. 81. | ....    | 81<br>86<br>84 | At anchor mostly.<br>South Channel Buoy<br>South 4'.                                                                                              |
| 12th Oct. | 1 Brig Teak.                                      | 18. 9.             | S. S. E. to 3 A. M.<br>when South and S. S.<br>E.; at 8 P. M. S. S. E.<br>4 P. M. S. E., furious<br>gale and sea a sheet of<br>foam. | 29. 50.                                                     | 30. 10. | 82             | Running to W. N. W.<br>P. M. hove too. Mid-<br>night clearing a little,<br>Bar. at 6 P. M. 29. 42,<br>and at 10 29. 62; Simp.<br>30. 5 to 30. 20. |

| Date.              | No. | Name of ship or Station. | Lat. N. | Long. East. | Winds and Weather.                                                                                                           | Bar.    | Simp.   | Ther. | Remarks.                                                                |
|--------------------|-----|--------------------------|---------|-------------|------------------------------------------------------------------------------------------------------------------------------|---------|---------|-------|-------------------------------------------------------------------------|
| 1848.<br>12th Oct. | 2   | Joven Corinna.           | 15° 25' | 94° 14'     | Strong squalls, rain and thick gloomy weather; strong wind from S. b. W. to S. S. W. and S. W. veering to South and S. b. E. | 29. 70. | 29. 17. | 82½   | Clouds, dense strata throughout; towards midnight inclined to clear up. |
|                    | 3   | Enigma.                  | 19. 19. | 90. 28.     | P. M. E. S. E. E. mid-night S. E. strong gales, continued heavy squalls.                                                     | ....    | ....    | ....  | Vessel scudding to the N. W.                                            |
|                    |     | At KYOOK PHYOO.          | 19. 26. | 93. 34.     | Blowing fresh, East to S. S. E. light rain and squally appearance.                                                           | 29. 80. | ....    | 88    | ....                                                                    |
|                    |     | At ANYAB.                | 20. 08. | 92. 55.     | Daylight wind E. S. E. P. M. the same; strong squalls to midnight.                                                           | 29. 65. | ....    | ....  | ....                                                                    |
|                    | 4   | Eagle.                   | 20. 02. | 90. 30.     | Heavy gales E. S. E. to 4 P. M. when S. E.                                                                                   | 29. 20. | ....    | ..:   | ....                                                                    |
|                    | 5   | Ararat.                  | 19. 11. | 89. 6.      | A. M. E. b. N. Noon N. E. increasing gale P.; M. N. E. b. E. 10 P. M. very hard gale.                                        | 29. 50. | ....    | ....  | Barometer falling and sea getting up.                                   |
|                    | 6   | Flora McDonald.          | 16. 47. | 91. 16.     | E. S. E. strong gales P. M. S. E. b. E.                                                                                      | ....    | ....    | ....  | Same weather to mid-night.                                              |

| 12th Oct. | 7  | Barham.            | 16° 51'. | 88° 23'. | A. M. unsteady breeze N. W. Noon thick with hard squalls. P. M. W. S. W. at 7. Midnight S. S. W. hurricane.                                                              | 29. 40.          | 29. 12. | .... | Daylight Bar. 29.70; out 2 reefs; birds flying on board. Noon hove to, 4 P. M. Bar. 29.20.                                                          |
|-----------|----|--------------------|----------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
|           | 8  | Wellesley.         | 16. 20.  | 87. 00.  | Wind West, gusty and increasing; 3 P. M. West; Midnight veering to S. west.                                                                                              | 29. 60.          | 29. 08. | 83°  | 3 P. M. Hove too, to midnight torrents of rain, and lightning; 8 P. M. Bar. 29.50; Simp. 29. 00.                                                    |
|           | 9  | Sea Park.          | 17. 54.  | 89. 26.  | First variable airs to 2.30 P. M. when South-erly breeze; midnight S. S. E. hard gale and heavy gusts of wind and rain.                                                  | 10 A. M. 29. 38. | ....    | .... | Bar. and Simplesome-ter falling, when the rise should take place. Ship covered with land birds and hove to 4 P. M. in 18° 6' N. 89° 25' East.       |
|           | 10 | Asiatic.           | 19. 32.  | 88. 19.  | Noon N. E. gale and close reefs; midnight East, heavy gales.                                                                                                             | 4 P. M. 29. 40.  | ....    | .... | Bar. from 4 P. M. fal-ling from 29.40 to 28. 94 at midnight.                                                                                        |
|           | 20 | British Sovereign. | 16. 37.  | 88. 38.  | A. M. variable, North to W. N. W.; 4 heavy squalls from North; 6 gale at West; Noon W. S. W. thick dark cloudy weather; 9 S. W. b. W.; midnight S. W. furious hurricane. | 29. 50.          | ....    | .... | Ship running to the North; at 8 P. M. hove too in 17° 17' N.; 88° 35' East; heavy thunder and lightning; Bar. 29.50 at P. M. to 29.20 at mid-night. |

| Date.     | No. | Name of Ship or Station. | Lat. N.         | Long. East. | Winds and Weather.                                                                                                                  | Bar.    | Simp.   | Ther. | Remarks.                                                                                                     |
|-----------|-----|--------------------------|-----------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------|---------|---------|-------|--------------------------------------------------------------------------------------------------------------|
| 12th Oct. | 21  | Chas. Kerr.              | 19° 36'         | 87° 52'     | 2 A. M. increasing breeze; Noon hard gales N. N. E. midnight wind North.                                                            | 29. 60. | 29. 30. | 82    | Midnight 11th Black Pagoda N. W. b. W. 3 miles. Ship standing to the Eastward. Midnight 29.50; Simp. 29.20.  |
|           | 11  | Sir Robt. Seppings.      | 19. 27.         | 87. 20.     | Strong Northerly breezes p. M. North, strong gale and heavy rain and squalls.                                                       | 29. 79. | ...     | 86    | 8 P. M. Bar. 29.55 and gale increasing, hove too. Midnight 29.50, hard gale.                                 |
|           | 12  | Camperdown.              | ....            | ....        | ....                                                                                                                                | 29. 60. | ....    | ....  | Noon Pilot Vessel N. N. E. 15. Stood to the S. E. 11 P. M. hard squalls.                                     |
|           | 13  | Collingwood.             | 17. 46.         | 89. 06.     | Variable from N. west and squally; p. M. variable N. westward; 4 West; 7 S. b. E. to S. S. E. at 10 S. E. b. S. increasing rapidly. | 29. 37. | ....    | ....  | Standing to N. N. E. and N. E. 3 P. M. Bar. 29.25 and falling fast; midnight ship running to the N. E. b. N. |
|           | 14  | Edmundsbury.             | 2 Alts. 19. 53. | 86. 11.     | Fresh gale; strong squalls, wind N. E. to East; 5 P. M. strong gale East to N. E. midnight hard gale.                               | 29. 60. | ...     | ...   | Noon heavy appearance to the Eastward. Midnight Bar. 29.50                                                   |

| 12th Oct. | 15                 | Framjee Cowasjee. | 20. 18. | 29. 27. | Noon heavy squalls, to midnight increasing gale from E. b. N.                                                                                   | 29. 46. | .... | .... | Working to the Eastward, heavy westerly set; 9.30 p. m. hove too. Midnight in about 20° 0' N. 88° 37' East.                                                     |
|-----------|--------------------|-------------------|---------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------|------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           |                    | At BALASORE.      | ....    | ....    | N. W. breeze, very cloudy, rain from N. E. with heavy gusts.                                                                                    | 29. 64. | .... | 82½  | ....                                                                                                                                                            |
| 16        | Washington Alston. | 19. 2.            | 88. 46. |         | Wind E. N. E. p. m. heavy gales; 5 p. m. East; 10 p. m. S. E.                                                                                   | ....    | .... | .... | 5.30 p. m. hove too; midnight very heavy gale.                                                                                                                  |
| 17        | John Hepburn.      | 17. 35.           | 89. 36. |         | Winds light and variable from N. E.; 9 light winds S. E. Noon squally, p. m. increasing 2.30 strong gales S. E. 6 p. m. to midnight, hurricane. | ....    | .... | .... | Very threatening appearance to the S. westward, Bar. A. m. 29.38; 7, 29.30; Ther. 82.—Dense black appearance to the S. W. p. m. Bar. falling fast, 9 Bar. 29.9. |
| 18        | Easurain.          | 17. 05.           | 86. 06. |         | A. m. N. W. freshening gale; 8 W. b. N. p. m. moderating N. W. b. W. and W. N. W.; at 8 light airs.                                             | ....    | .... | .... |                                                                                                                                                                 |
| 19        | Fattle Rozack.     | 19. 18.           | 87. 45. |         | A. m. wind variable E. N. E. to E. S. E. 3 A. m. shift to N. N. E. p. m. N. N. E. dark gloomy weather.                                          | 29. 59. | .... | .... | 10 A. m. Dark red clouds about 5° in Alt. Ship running to the S. W. and South.                                                                                  |

| Date.     | No. | Name of Ship or Station.                   | Lat. N. | Long. East. | Winds and Weather.                                                                                                                                                                                                                      | Bar.                                                        | Simp.   | Ther. | Remarks.                                                                                                                             |
|-----------|-----|--------------------------------------------|---------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|---------|-------|--------------------------------------------------------------------------------------------------------------------------------------|
| 12th Oct. |     | H. Co.'s Floating L. V. Hope.              | 21° 4'  | 85° 27'     | H.<br>C. PILOT AND LIGHT<br>A. M. Fresh Easterly and cloudy; 8 strong E. N. E. cloudy and squally. Noon strong N. E. b E.; 4 P. M. strong Easterly wind, heavy sea. Midnight blowing strong at East, heavy squalls, rain and heavy sea. | VESSELS.<br>29. 79.                                         | 29. 60. | 86    | Two Barometers on board; 4 P. M. veered to 120 fms. Sunset strong set to the Westward.                                               |
|           |     | H. C. P. V. Fame, at the F. L. V. station. | ....    | ....        | Strong winds from East and thick dirty weather with squalls; Noon to midnight N. E. to E. S. E.                                                                                                                                         | 8 A. M.<br>29. 96.<br>Noon<br>29. 94.<br>4 P. M.<br>29. 86. | ....    | ....  | ....                                                                                                                                 |
|           |     | H. C. P. V. Salween.                       | ....    | ....        | First part fresh breeze East to S. E. and very clear atmosphere; middle squally and latter moderate E. N. E.                                                                                                                            | 29. 90.                                                     | ....    | ....  | ....                                                                                                                                 |
|           |     | H. C. P. V. Colleroon.                     | ....    | ....        | Daylight strong Easterly breezes and squally, 10.30 blowing a gale from East; 8 P. M. strong gales East to E. S. E.                                                                                                                     | ....                                                        | ....    | ....  | Lightning to the N. W. Bar. 8 A. M. 29. 80; Noon 29. 73; 4 P. M. 29. 76; 8 P. M. 29. 73; Ther. 84 to 85°. Riding with 160 ft. cable. |

| 1848.<br>13th Oct. | H. C. F. L. V. Beacon,<br>Middleton<br>Point Station. | ....    | ....    | Noon strong E. N. E. breezes and squalls p. m. to midnight E. N. E. to N. E. thick cloudy weather.  | Noon<br>29. 77.<br>p. m.<br>29. 74.<br>Mid.<br>29. 70. | ....    | 80<br>84<br>84 | Strong appearances of bad weather.                                                               |
|--------------------|-------------------------------------------------------|---------|---------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------|---------|----------------|--------------------------------------------------------------------------------------------------|
|                    |                                                       |         |         |                                                                                                     |                                                        |         |                |                                                                                                  |
| 1                  | Brig Teak.                                            | 18. 32. | 89. 17. | Noon S. E. strong gale.                                                                             | 29. { 65.<br>63.                                       | 30. 25. | 82             | 6 A. M. bank of clouds to the S. W. Sea running in high pyramids; 8 P. M. bore up and made sail. |
| 2                  | Joven Corinna.                                        | 15. 50. | 93. 11. | Winds variable from S. b. E. and squally.                                                           | 29. 73.                                                | 29. 26. | 82             | At midnight fine.                                                                                |
| 3                  | Enigma.                                               | ....    | ....    | Wind N. S. E. 1 P. M. East, lying too.                                                              | ....                                                   | ....    | ....           | Signalled to sea again by the Pilot.                                                             |
|                    | At KROOK PHVOO.                                       | 19. 26. | 93. 34. | Moderate and fine S. S. E. to N. W.                                                                 | 29. 80.                                                | ....    | 84             | ....                                                                                             |
|                    | At AKYAB.                                             | 20. 08. | 92. 65. | Blowing fresh East to E. S. E. strong gale S. E. Noon dark cloudy weather with heavy squalls South. | 29. 50.                                                | ....    | ....           | Midnight moderate; an immense rise of tide from Chedoba to Chit-tagong for miles in shore.       |
| 4                  | Eagle.                                                | 19. 54. | 89. 12. | Wind S. E. hard gale, squalls and heavy rain; 11 P. M. S. S. E.                                     | 29. 20.                                                | ....    | ....           | Midnight heavy thunder and vivid lightning to the S. W. hard gales S. S. E. bore to through-out. |

| Date.              | No. | Name of ship or Station. | Lat. N. | Long. East. | Winds and Weather.                                                                                     | Bar.     | Simp.   | Ther. | Remarks.                                                                                                      |
|--------------------|-----|--------------------------|---------|-------------|--------------------------------------------------------------------------------------------------------|----------|---------|-------|---------------------------------------------------------------------------------------------------------------|
| 1848.<br>13th Oct. | 5   | Ararat.                  | 19° 20' | 88° 30'     | 6 A. M. E. S. E. terrific gale; P. M. N. E. 6. 45 hurricane S. W.                                      | 29° 00'* | ....    | ....  | 3 P. M. Bar. 29.00; 4 28.6, 6.45; centre had passed 8h. 30; Bar. rising to 29.10. Ship surrounded with birds. |
|                    | 6   | Flora Macdonald.         | 20. 20. | 90. 30.     | A. M. S. E. P. M. South P. M. S. b. E. Strong gales and squalls throughout.                            | ....     | ....    | ....  | ....                                                                                                          |
|                    | 7   | Burham.                  | 17. 52. | 89. 14.     | 6 A. M. S. S. E. P. M. S. S. E. moderating.                                                            | 29. 58.  | 29. 30. | 82½   | P. M. Bore up North. Midnight strong breeze with hard squalls, and vivid forked lightning.                    |
|                    | 8   | Wellesly.                | 16. 53. | 88. 2.      | S. W. to S. S. W. Noon wind shifting to the Southward, but still with hard squalls.                    | ....     | ....    | ....  | Bore up E. N. E. Heavy confused sea from all quarters.                                                        |
|                    | 9   | Sea Park.                | 18. 20. | 89. 06.     | Daylight S. E. very hard gale, P. M. S. b. E. steady Southerly gale throughout.                        | 29. 63.  | 29. 35. | ...   | Midnight more moderate.                                                                                       |
|                    | 10  | Asiatia.                 | 19. 8.  | 86. 08.     | A. M. East; 7 A. M. E. N. E. hard gales Noon hurricane E. N. E.; 4 P. M. North to N. W.; midnight West | 28. 86.  | ....    | ....  | Bar. from 28.97; at 1 A. M. to 28.60; at 8 P. M. 29.20; at midnight when moderating.                          |

\* See Note at page —.



|    |                     |         |         |                                                                                                                                                                            |         |         |      |                                                                                                                                                                                                 |
|----|---------------------|---------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20 | British Sovereign.  | 17. 36. | 88. 33. | A. M. South 4 S. S. E.<br>6 S. E. at 8 S. S. E. 11<br>South; heavy gale with<br>rapid gusts.                                                                               | 29. 40. | ....    | .... | By 8 A. M. wind abat-<br>ing; Bar. 29.20; at 1<br>A. M. to 29.40 at Noon.                                                                                                                       |
| 21 | Chas. Kerr.         | 19. 02. | 87. 27. | Gale increasing to<br>Noon; 10 A. M. W. N.<br>W., noon dense atmos-<br>phere rain and sleet P. M.<br>S. S. W. b. S. 7 South.                                               | 28. 90. | 28. 70. | 79   | Ship keeping before<br>the wind; 2 P. M. glasses<br>began to rise.                                                                                                                              |
| 11 | Sir Robt. Seppings. | 19. 40. | 88. 00. | A. M. East to N. E.<br>gale P. M. N. E. hard<br>gales; 2 P. M. wind S.<br>E.; 5 S. S. E.; 6 P. M.<br>S. E. to South; 7 S. S.<br>W.; 8 South; midnight<br>S. E. to S. S. W. | ....    | ....    | .... | A. M. and at 2 P. M.<br>moderating; at 7 P. M.<br>lost masts. Position dur-<br>ing the height of the<br>hurricane about 19.30;<br>87.35 E.                                                      |
| 12 | Camperdown.         | ....    | ....    | Blowing hard E. N.<br>E. to East; Noon ab-<br>out East; 7.30 P. M.<br>hurricane from W. S.<br>W.; 8.30 S. S. W.                                                            | 29. 00. | ....    | .... | Close reefing Bar. 3<br>A. M. 29.20; 5 P. M.<br>28.90; at 7 28.50; 5<br>P. M. 28.90; at 7 28.<br>50, from 7 to 7.30 a lull;<br>midnight Bar. 28.50;<br>having fallen lower in<br>this interval. |
| 13 | Collingwood.        | 20. 27. | 87. 30. | Noon wind E. S. E.<br>P. M. moderate gale E.<br>b. N.; 4 P. M. E. N.<br>E.; 7.30 hurricane E.<br>S. E.; 10 S. E.; 12,<br>South.                                            | 29. 50. | ....    | 82   | Bar. 28.80 at 8 P. M.<br>7.30 P. M. has de mast-<br>ed; midnight hurricane<br>still raging.                                                                                                     |

| Date.              | No. | Name of Ship or Station. | Lat. N. | Long. East. | Winds and Weather.                                                                                                                             | Bar.    | Simp. | Ther. | Remarks.                                                                                                      |
|--------------------|-----|--------------------------|---------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|-------|---------------------------------------------------------------------------------------------------------------|
| 1848.<br>13th Oct. | 14  | Edmundsbury.             | 19° 21' | 87° 49'     | A. M. N. E. threatening; Noon hard gale; P. M. hurricane N. E.; 6.30 shifted to the N. W. at 8 hurricane W. b. N. midnight S. W.               | 29° 20' | ....  | ....  | 4 P. M. more moderate and calm; 6.30 hurricane from S. W. Bar. 5 P. M. to 7 28.60; midnight 28.98; wind S. W. |
|                    | 15  | Franjee Cowasjee.        | 20. 0.  | 87. 30.     | A. M. Heavy gale E. N. E. P. M. E. b. N.; 5 P. M. moderating; 6 hauling to North and S. W. wind W. S. W.; at 8 calmer midnight hurricane S. W. | ....    | ....  | ....  | Bar. at midnight 28.90; position merely estimated.                                                            |
|                    |     | At BALASORE.             | ....    | ....        | Shifting E. N. E. to E. S. E. heavy rain.                                                                                                      | 29. 60. | ....  | 82    | Upper clouds travelling from the S. W.                                                                        |
|                    | 16  | Washington Alston        | 19. 44. | 88. 03.     | At 6 A. M. S. E. Noon South.                                                                                                                   | ....    | ....  | ....  | Ship in much distress. Before Noon dismasted.                                                                 |
|                    | 17  | John Hepburn.            | 18. 50. | 89. 46.     | A. M. wind about S. E. moderating a little; wind veering to South.                                                                             | 29. 59  | ....  | ....  | Daylight Bar. 29.50.                                                                                          |
|                    | 19  | Futtle Rozack.           | 17. 17. | 88. 5.      | A. M. Blowing fearfully N. N. W. 3 A. M. N. W. b. N. 11 W. b. N. Noon more moderate; P. M. moderating west S. W. and S. W. S.                  | 29. 57. | ....  | ....  | Ship running to the South and S. E.; 10 P. M. heavy squalls and thunder and lightning.                        |

| 13th Oct. | H. C. Floating Vessel.              | 21. 4. | H. 88. 27. | C. Pilot and Light                                                                                                                                                | Vessels.                                                                                                           | ...  | 80°  | Two Barometers on board, but differing greatly. Their fall from noon to midnight is 0.1 and 9.08. respectively. |
|-----------|-------------------------------------|--------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|------|------|-----------------------------------------------------------------------------------------------------------------|
|           | H. C. P. V. Fame, F. L. V. Station. | ....   | ....       | A. M. strong Easterly winds; 4 A. M. strong gales E. S. E. to E. N. E.; noon E. N. E.; 4 P. M. increasing at N. E. 8 P. M. E. N. E. fearful heavy gusts and rain. | 8 A. M. 29. 76.<br>Noon 29. 75.<br>29. 58.<br>4 P. M. 29. 71.<br>29. 71.<br>29. 50.<br>Midnight 29. 65.<br>29. 50. | .... | 80°  |                                                                                                                 |
|           | H. C. P. V. Fame, F. L. V. Station. | ....   | ....       | Daylight blowing fresh E. S. E. to East with a heavy sea; 1 P. M. weather worst; 6 heavy squalls E. S. E.; P. M. gale E. S. E. to S. E.                           | 8 A. M. 29. 84.<br>Noon 29. 71.<br>4 P. M. 29. 55.                                                                 | .... | .... | 6 P. M. Parted and stood to sea and laid too in 23 fa. water.                                                   |
|           | H. C. P. V. Salween.                | ....   | ....       | Strong gale E. N. E. latter part E. S. E. heavy squalls and gusts.                                                                                                | A. M. 29. 77.<br>Noon 29. 80.<br>6 P. M. 29. 60.                                                                   | .... | .... | ....                                                                                                            |
|           | H. C. P. V. Colleen.                | ....   | ....       | 5.30 A. M. heavy gale from East. Noon East to E. N. E. 3 P. M. East to S. E.; 8 P. M. East to S. E.                                                               | ....                                                                                                               | .... | .... | Throughout hard gales, rain and heavy sea. Bar. 8 A. M. 29. 72; noon 29. 80; after which obliged to unship it.  |

| Date.              | No. | Name of Ship or Station.                        | Lat. N. | Long. East. | Winds and Weather.                                                                                                                   | Bar.                                             | Simp. | Ther.           | Remarks.                                                                                                                  |
|--------------------|-----|-------------------------------------------------|---------|-------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------|-----------------|---------------------------------------------------------------------------------------------------------------------------|
| 1848.<br>13th Oct. |     | H. C. F. L. V. Beacon, Middleton Point Station. | ....    | ....        | To 8 P. M. strong N. E. gales with heavy squalls and rain. From 8 P. M. to midnight increasing at E. N. E. veering to East and S. E. | Noon 29.66.<br>8 P. M. 29.67.<br>Midnight 29.61. | ....  | 74*<br>78<br>79 | At 8 P. M. lightning all round and every appearance of worse weather.                                                     |
| 14th Oct.          | 11  | Sir Robt. Seppings.                             | 19. 45. | 87. 50.     | 1 A. M. S. S. W.; 4 A. M. South. To Noon S. b. E.; at 8 more moderate. P. M. S. S. W.                                                | 29. 10.                                          | ....  | 79              | ....                                                                                                                      |
|                    | 12  | Camperdown.                                     | ....    | ....        | 1 A. M. Bar. 29.00 wind S. S. W.                                                                                                     | ....                                             | ....  | ....            | Daylight in 17 fs. False Point N. W.; 7 miles.                                                                            |
|                    | 13  | Collingwood.                                    | ....    | ....        | 3 A. M. S. S. W.; 4 hurricane moderating; noon S. b. W. decreasing.                                                                  | 29. 30.                                          | ....  | ....            | At 6 A. M. came too with False Point Light S. b. W.                                                                       |
|                    | 14  | Edmundsbury.                                    | 20. 2.  | 87. 7.      | 4 A. M. wind S. S. W.; 11 A. M. South.                                                                                               | 29. 60.                                          | ....  | ....            | Moderating during the day.                                                                                                |
|                    | 15  | Framjee Cowajee.                                | ....    | ....        | Hurricane from S. W. Noon moderating.                                                                                                | ....                                             | ....  | ....            | 5 A. M. lost main and misen masts. Daylight passed Edmundsbury in 19.45 N.; Long. 86° 38' East; Bar. at 2.30 A. M. 29.32. |

| 14th Oct. | At BALABORE.                          | .... | ....    | 6 P. M. wind E. N. E.                                                                                                                                                                                | 29. 49.                                                                                                                                | ....                                              | 81                    | Rise of water at the tide gauge 8 ft. above spring tides.                                      |
|-----------|---------------------------------------|------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------|
| 16        | Washington Alston                     | .... | ....    | Blowing hard S. W. all night.                                                                                                                                                                        | ....                                                                                                                                   | ....                                              | ....                  | A. M. gale abated.                                                                             |
|           | H. C. P. F. L. 21. 4.<br>Vessel Hope. | .... | 88. 27. | H. C. PILOT AND LIGHT<br>Daylight strong S. E. gales with heavy gusts of wind; 8 A. M. S. E. noon S. S. E.; 4 P. M. Southward; midnight strong S. b. W. gale; heavy squalls rain and sea throughout. | VESSEL.<br>A. M.<br>29. 65.<br>29. 50.<br>8 A. M.<br>29. 76.<br>29. 56.<br>Noon<br>29. 70.<br>29. 54.<br>8 P. M.<br>29. 80.<br>29. 60. | ....<br>}....<br>}....<br>}....<br>}....<br>}.... | 81<br>81½<br>84<br>85 | ....                                                                                           |
|           | H. C. P. V. Fame.                     | .... | ....    | Winds fresh S. S. E. to South throughout.                                                                                                                                                            | 8 A. M.<br>29. 85.<br>Noon<br>29. 91.<br>4 P. M.<br>29. 91.                                                                            | ....                                              | ....                  | 4 A. M. Off Point Pal-<br>miras a little to the North of the Ridge; 3 P. M. anchored in 19 fa. |
|           | H. C. P. V. Salween.                  | .... | ....    | Fresh gale S. S. E. hard squalls and lightning.                                                                                                                                                      | 29. 72.<br>P. M.<br>29. 70.                                                                                                            | ....                                              | ....                  | At noon moderating.                                                                            |

| Date.              | No. | Name of Ship or Station.                        | Lat. N. | Long. East. | Winds and Weather.                                                                                                                                          | Bar. | Ship. | Ther. | Remarks.                                                                                                                           |
|--------------------|-----|-------------------------------------------------|---------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-------|------------------------------------------------------------------------------------------------------------------------------------|
| 1848.<br>14th Oct. |     | H. C. P. V. Colleen.                            | ....    | ....        | Continued gale East to S. E. 3 A. M. E. S. E.; 8 A. M. veering to S. S. E.; noon S. S. E. to South; P. M. from S. S. E. to South in heavy gusts.            | .... | ....  | ....  | A. M. the hardest squalls of the gale; P. M. lightning to the Southward and Eastward. Throughout at anchor in the South Channel.   |
|                    |     | H. C. F. L. V. Beacon, Middleton Point Station. | ....    | ....        | Gale continuing from about S. E. till 8 P. M. when moderated at S. S. E.; midnight strong Southerly breeze.                                                 | .... | ....  | ....  | Bar. 8 A. M. 29.61 and 7h. 81°; noon 29.72 and Ther. 84; P. M. 29.65; Ther. 83; 8 P. M. 29.73; Ther. 82; midnight 29.70; Ther. 81. |
| 15th Oct.          |     | H. C. F. L. V. Hope.                            | ....    | ....        | A. M. strong S. b. W. gales, heavy squalls and rain; noon S. S. W. to S. W.; 4 P. M. moderating very fast at S. W.; 8 strong S. S. W. winds; midnight fine. | .... | ....  | ....  | 8 A. M. Bar. 29.85 and 29.64; Ther. 82; noon 29.90 and 29.61, Ther. 82°; 4 P. M. 29.95 and 29.65.                                  |
|                    |     | H. C. P. V. Colleen.                            | ....    | ....        | A. M. hard gale, S. to S. b. E. moderating after noon when wind South.                                                                                      | .... | ....  | ....  | ....                                                                                                                               |

## PART II.—SUMMARY.

From the foregoing details and tables I now proceed to shew upon what considerations the places of the centres of this Cyclone for the different days have been laid down, inserting here, for more convenient reference to the diagrams on the chart, a list of the numbers affixed to each ship's name in the foregoing table.

INDEX TO THE NUMBERS OF THE SHIPS ON THE CHART AND  
DIAGRAMS.

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| 3. Enigma. ....               | 830          |
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Before entering on the details of the positions of the centres of the Cyclone, for different days, I am desirous of making a few remarks on the positions of the ships, as shewn by their logs or the notes transmitted to me.

It will be seen that there are four differently marked classes of tracks on the chart. These are :—

1. Ships inward bound from the Southward.
2. Ships inward bound from Madras or from the Eastward.
3. Outward bound ships.
4. Ships standing to sea from the Pilot station.

Now of these four classes the ships of which the positions are the most certain are those from Madras, as having had good observations but a day or two before.

Next to these are the ships inward bound, from the Southward and those from the Eastward, though both were subjected to considerable chances of error, as some of the ships from Europe had run up from 7° North in continued gloomy weather, and those from the Eastward had had two or three days of bad weather from the Prepara passage.

The ships standing to sea, whether as outward bound or as standing off by orders from the station vessel, or under charge of their pilots, were enveloped in the strong current which I have elsewhere announced, and which we see here from the logs of several ships,\* and especially the *Camperdown*, sets at a rapid rate across the Sand Heads to the Westward at the approach of a Cyclone; and it is probable also that the ships in the vicinity of the coast about Point Palmiras, and to the Southward, were much affected by the sweep of this current, which no doubt curves round within Balasore Bay and past the Point: at least we cannot reasonably suppose any other direction for it.

On the 9th of October we cannot fairly assign any position for the centre, though as the *Teak* and *Enigma* in the Andaman Sea about the latitude of Narcondam, were running up with a strong S. S. W. breeze, while the *Joven Corinna*, outside in the Bay of Bengal, had a strong Easterly breeze; these might at first have been thought part of a Cyclone circle, of which the centre in that case would fall in about 12° 30' North; and 92° 00' East: or about 1° West of the body of the Great Andaman, and Captain Connew, it will be seen, thinks they "brought it up from the Sayer Islands;" but at the close of the monsoons smart blowing weather is often experienced on the Eastern side of the Bay, and the next day was fine again, for—

\* At the trial of a Branch Pilot before a Marine Court for failing to take a pilot out of an outward bound ship, it was proved on oath that the Westerly set at the station vessel was not less than from three to four knots per hour on the 11th October.



On the 10th October, we find the *Teak*, *Enigma* and *Joven Corinna* with tolerably fine weather and the wind between S. S. W. and S. E., some of the vessels carrying studding sails: we cannot thus allow that either on the 9th or 10th we have any sort of data for assuming the presence of a Cyclone, which had it existed must have had its centre to the Westward, and W. S. W. of these ships, and consequently have reached the *Sea Park* and *British Sovereign*, the next ships to the Westward, and have given them a Northerly wind. There is only one circumstance which we are a little puzzled to account for, which is the presence of the land birds and insects on the 12th on the *Sea Park* and other vessels. These it is clear must have been brought from some of the land to the Eastward or S. Eastward, that is either from the coast of Pegue above Point Negrais, or from the Andamans. We might suppose indeed that, according to Captain Connew's view, the Cyclone existed as such within the Andaman Sea, and that it was lifted up by the high mountain range of the Andaman Islands, and descended again in the Bay, which we know to happen with Cyclones crossing the peninsula of India, and descending, or being again as it were, renewed in the Arabic Sea. This supposition would account perhaps in part for the depression of the Barometer of the *Joven Corinna*, but we cannot go farther than to indicate these doubtful points in the absence of any evidence to prove them: I shall refer again to this singular phenomenon.

On the 11th October.—It is difficult also to assign any position for a centre, or even to affirm that any Cyclone existed in the Bay, for though we have the *Barkham*, *Collingwood*, *Sea Park*, *Enigma*, *Ararat* and *Teak* dispersed over a sort of curved or hooked line of  $4^{\circ}$  of Longitude, and  $2\frac{1}{2}^{\circ}$  of Latitude, there is nothing like Cyclone weather to be found in their logs, nor any thing approaching to a gale. The mere winds of the three nearest to any supposed centre, i. e. *Teak*, *Sea Park* and *Collingwood*, might indeed give us a spot about  $90^{\circ}$  East;  $14^{\circ} 50'$  North, as a centre, but the *British Sovereign* must have been crossing near this spot on the 11th, and she carried the somewhat stormy, but not unusual, October S. W. monsoon with which she had run up from  $7^{\circ}$  North past it, and the *Sea Park* and *Collingwood* had both fine weather up to noon. Hence we cannot I think for this day at noon, by any sort of construction, allow that we have any data fairly

indicating that a Cyclone had commenced *at the surface of the ocean*. As before remarked, it might have been, and probably was, formed or coming up overhead. Towards the close of this day many of the ships began to have indubitable signs of its approach, or indeed I may rather perhaps say of its *descent*.\*

*On the 12th of October.*—If we examine the diagram which I have placed with the chart, in which the numbers signify the ships according to the table just given, and the little arrows their winds (though the force of these is not expressed), we shall see that on the N. Eastern quadrant of the Cyclone we have at noon the *Enigma* (3) and *Eagle* (4) with “strong gales” and “heavy gales” at E. S. E., while the *Teak* (2) nearer to the centre but in the same quadrant has “a furious gale with the sea one sheet of foam.” On the opposite or S. W. quadrant we have the *Barham* (7) with thick weather and hard squalls, heaving too at noon, from the conviction that they were within the verge of a Cyclone, and that standing on, though the wind was fair, would plunge them into the centre; and the *British Sovereign* (20) with “a steady heavy gale” just allowing her to set the reefed foresail. She was, as remarked at the close of her log, probably a little farther to the Eastward.

On the North western and Northern quadrants we have a group of six vessels inward and outward bound, of which the first two, the *Ararat* (5), and *Washington Alston* (16), at the same distance from our centre as the *Barham* and *British Sovereign*, and both like them with strong and increasing gales.† The four others, *Asiatic* (10), *Edmondsbury* (14), *Futtle Rozack* (19), and *Charles Kerr* (21), had also heavy weather, and the Cyclone fairly set in with them, both from the fall of their Barometers, the strength of the wind and the unquestionable appearance of the weather. We have unfortunately no record of the weather on the Eastern quadrant.

We may thus take the diameter of the Cyclone for this day to have

\* Adopting, only for the present, my own theory of these meteors, that they are formed above and descend as disks to the surface of the ocean, as a more convenient form of expression, and one which seems much more justified by the phenomena of the following day, than the word approach.

† They have both also the same apparent discrepancies in the directions of their wind-arrows, but this may arise from many causes, as 1. The wind carelessly marked—2. Ship’s position uncertain—3. Incurving of the wind at the time.

been not quite 300 miles? or 150 miles of semi diameter on its advancing semicircle, for the *Sir Robert Seppings* (11), and *Framjee Cowajee* (16) (this last with a pilot on board) had a heavy sea, squalls and threatening appearances, but did not make their preparations for bad weather till the afternoon: and if we refer again to the diagram we shall find that at the centre of the wind circles we have a space, marked by a double line, of 50 miles in breadth, within which are three ships, in a small right angled triangle, of which the greatest side is only 33 miles, with winds and weather at this time, as follows:

- |                          |                                                                                                |
|--------------------------|------------------------------------------------------------------------------------------------|
| 9. <i>Sea Park.</i>      | { Faint variable airs from the S. W. Bar. falling fast, birds, &c., taking refuge on the ship. |
| 13. <i>Collingwood.</i>  |                                                                                                |
| 17. <i>John Hepburn.</i> | —Moderate and squally from the S. E.                                                           |

Two of these vessels also, the *Hepburn* and *Collingwood*, sighted ships between daylight and noon under storm sail, and with top gallant masts down.\*

It is evident then from these light opposing winds and dark gloomy weather, with other phenomenon prevailing within this tract, while a gale and even a heavy gale was blowing around it, that these ships are within a broad central space, which I have marked for the centre of the Cyclone. I defer to the concluding remarks the strong evidence which this affords not only of the fact that Cyclones are, as I have already announced,† sometimes almost *Zonal*, when the proportions of the central to the storm portion are considered, but moreover of the fact that Cyclones are lifted up and *descend* again! I take the centre of the Cyclone then at noon this day to have been about in Lat. 17° 48' N.; Long. 89° 18' East. And we should remark also that its violence was not yet sufficient to dismast any of the vessels within its influence.

*On the 13th October.*—We have a diagram, which upon considering some of the wind-arrows, appears rather an anomalous one, but we have first to consider if the ships' positions are correctly laid down, and this

\* Probably the *Victoria* and three other outward-bound vessels, the logs of which have not reached me.

† *Journal Asiatic Society*, Vol. XIV. p. 907.

no one can possibly answer for, although many are but just from sight of the land, or from the pilot, yet several are now two or three days without observations, in strong or severe gales, and some no doubt within the influence of the storm wave and current.

The nearest vessel to the centre at noon on this day was the *Ararat*, No. 5, which vessel had the centre passing her between 4h. and 6h. 45' P. M., or say at 5 P. M.

At 1 P. M. the wind is marked as N. E. and her position is given by Acct. as in  $19^{\circ} 20'$  North ; Long.  $88^{\circ} 30'$  East ; but upon examining and working over her log I do not consider that sufficient allowance has been made for leeway and drift in such weather as she evidently had ; the gale, being described in the log as "terrific" at 4 A. M. and the squalls "frightful" at noon, when no doubt they were close upon the centre. From these considerations then, and without any allowance for the storm wave, I have placed her at noon in  $19^{\circ} 31' N.$  ; Long.  $88^{\circ} 6' East$  ; and the centre close to her, as it was moving up from the S. Eastward, while she was drifting down across its track from the N. E.

The next to the *Ararat* is the *Sir Robert Seppings* (No. 11) also with the wind at N. E. of variable force, and veering to S. E. by 2, and S. S. E. by 5 P. M. and apparently most violent, at 7 P. M. when she had drifted close to the centre and lost her main and mizenmasts with other damage. The Cyclone passed close to her, but she did not, it seems, drift into its centre like the *Ararat*. Captain Stuart informs me that his position as estimated at 7 P. M. when at the height of the Cyclone, is he believes nearly correct, as he worked it with every allowance, both forward and backward.

We have then No. 14, the *Edmundsbury*. This ship was one of those which put to sea with her pilot on board, and must have been in much distress, for her ballast shifted in the Cyclone. As she experienced the calm and shift, her log and remarks are highly valuable, and I have calculated her position as nearly as possible. The *Camperdown*, No. 12, stood to sea from the pilot at noon of the 12th to the S. Eastward, but as the winds were barely at any time to the Northward of E. N. E. and mostly East, with a heavy lee current and sea and her leeway, she possibly may have been quite as much to the Westward as I have placed her, though not farther to the Southward at noon ; although she seems by her log to have headed to the South till she reached the

calm centre at 7 P. M. having the shift at 7.30. She was probably at this time to the South of the parallel of  $20^{\circ}$ , and as the Cyclone was curving a little, we can see that its position and hers closely approximate, which is all we can expect with so many sources of uncertainty.

The *Framjee Cowasjee*, it will be noted, is upon the parallel of  $20^{\circ}$  North, and she was on the advancing (Western) verge of the centre at about 6 P. M. when she had the wind North, and moderating to a calm at 8, which would place her also to the South of  $20^{\circ}$  and close on the track of the centre, as I have marked it. No. 21, the *Charles Kerr*, offers some anomaly of wind, or of position rendered erroneous by the effect of the storm wave and storm current, which as she was for a considerable time with the wind at North, and hemmed in between the coast and the advancing Cyclone, where she would perhaps have had moreover some part of the Southerly current from Point Palmiras, it is not unfair to suppose that she was a little farther to the Southward and Eastward than she supposed, which will account then for her having the wind so far to the Westward. This ship was also in great distress, her pumps being choked by the sand ballast; the wind at 10 A. M. is marked W. N. W. and P. M. S. W. b. S. so that it veered 7 points in two or three hours! showing that the ship was close upon the centre, and all hands probably too anxiously engaged in freeing the ship, as they were reduced to baling, to pay much attention to the exact direction of the wind for which I have therefore given a curved arrow. No. 20, the *British Sovereign*, is also an anomaly, if we suppose the Cyclone to have extended so far, but this it could barely have done, and the log of the *Teak* shews that there was a strong Southerly monsoon following the Cyclone.

The *Teak*, No. 2, also presents a slight anomaly, but she had now been three days without an observation, so that her position is necessarily uncertain.

The wind and position of the *Asiatic*, No. 10, however, are at first sight the most difficult to account for, as her position must be tolerably correct since she had just stood off from the coast on the 11th, and though with the N. E. and Easterly gales and hurricane which she had, she appears to have made little more than a W. S. Westerly drift between the 12th and 13th, yet as regards her Southing she must at least have been at noon on the 13th as far to the South as she is

placed, though she may have been more to the Eastward. Yet we find she had the wind at noon blowing a hurricane from E. N. E. veering to North at 4 P. M., and to N. W. at 8, when it was "impossible to look to windward." It is very clear that this could not have been any part of the main Cyclone, and I am thus inclined to believe it to be a smaller one thrown off from the main vortex, as we have so frequently seen occurs, especially when near coasts; and it is the more certain that this occurred as we find that the centre of the Cyclone passed False Point at 10 P. M. of the 13th, while the *Asiatic* was 72 miles to the South of that spot, near the centre of an evident Cyclone, or tornado Cyclone, blowing a hurricane at E. N. E. at noon; veering as we have just described, the ship having evidently drifted round the centre on its Western or advancing side; and from the brief report from Ganjam, as well as from the veering of this Cyclone, we may see it was travelling up to the N. N. W. at least, if not on a more Northerly track.\* The note we have from Ganjam, in Lat.  $19^{\circ} 22'$  N.; or about on the parallel of the *Asiatic's* position, shews that the Cyclone can only have skirted the coast there.

I have therefore with all these views placed the centre of the principal Cyclone for this day in Lat.  $19^{\circ} 12'$  N.; Long.  $88^{\circ} 13'$  East; and assigned a small separate one to the *Asiatic*.

On the 14th October at noon, we have the *Camperdown* (No. 12) and *Collingwood* (No. 13) close in with False Point, the latter ship indeed at anchor to the Northward of it, and the *Edmundsbury* and *Framjee Cowasjee* about 25 miles to the Southward of it. The Cyclone with all these ships was moderating between 1 and 4 A. M. from the South to S. S. W. and S. W. according to their positions, and by noon it was nothing more than a gale rapidly decreasing.

#### DESCENT OF THE CYCLONE ON THE 12TH, AND ITS PROBABLE ORIGIN.

If the Cyclone existed as one, at the surface of the ocean on any day preceding the 12th, we should doubtless find some distinct traces of it. For though we have as early as the 9th, and for the 10th, and 11th, strong and heavy Southerly and S. S. Westerly breezes on the

\* The whole veering (E. N. E. to West) would give a N. b. W. track for this little Cyclone.

Eastern side of the Bay, yet we find that all the ships towards the middle and on the Western side of the Bay are running up with strong Southerly and S. Westerly winds. Now if there was any Cyclone at this time we should have undoubtedly from so many ships some record of equally strong North Easterly, Northerly or North Westerly breezes but there is nothing of the kind.

As before remarked however, we have the puzzling fact of the numerous exhausted land birds which alighted on several of the ships (*Sea Park*, and *Barham*, on the 12th, and *Edmundsbury* and *Ararat* on the 13th) to account for, and if we allow that by any remote possibility those of the 13th might have been whirled into the vortex by a stream of wind at N. E. from the *Sonderbunds*,\* yet those of the 12th certainly could not have been so; and the nearest land to the centre on that day is *Cheduba*, at 330 miles distance to the E. N. E. with the coast of *Pegu* to *Point Negrais* to the Eastward, and the Northern *Andamans* to the S. Eastward.

Hence referring to what has already been said p. 893 of the winds, and of the appearances of the weather at the centre, and the falling of the Barometers of the ships on the 11th, we seem justified in saying that in this instance the Cyclone actually *descended* on the 12th, after passing over some land, from which it carried up the Ringdoves, Snipes, Parrot, Butterflies, &c. and that judging from its track this was more probably the *Andamans* than the Coast of *Pegu*: the S. S. Westerly winds of the *Joven Corinna* being an evidence that for the 10th and 11th, the centre of any Cyclone must have been to the South Westward of the *Preparis* passage.

Having shewn that the Cyclone must have settled down in the Bay of Bengal after having previously passed over some land to pick up the birds and insects which it brought with it, we are naturally led to enquire where it originally came from, since the bad weather experienced by the *Enigma* in the *Andaman Sea* does not give us any evidence for its formation there.

From several logs which have been forwarded to me it appears that,

\* They could not have been brought from the *Cuttack* coast, where the weather was moderate though threatening on the whole of the 12th.

† The average track is N. 41° West, and the average rate for the whole distance about 5' per hour.

from the 7th of October, there was bad weather indicating the approach of a Cyclone in the N. Eastern part of the China Sea, apparently by the Straits of Formosa, which by the 9th, was a severe Cyclone, in which H. M. S. Childers was nearly lost on the Pratas Shoal. I make the centre of this Cyclone to have been on that day in Lat.  $21^{\circ} 15'$  N.; Long.  $117^{\circ} 35'$  East; and that on the following day it had travelled about 285' to the W. b. S. Now from the position of this Cyclone in the China Sea on the 9th, as given above, to that of ours in the Bay of Bengal on the 12th in  $17^{\circ} 48'$  N.; Long.  $89^{\circ} 81'$  East, the course and distance is S.  $83^{\circ}$  W. 1530 miles, which in the 3 days gives 510 miles per day or 21 miles per hour.

If we then take this to have been the same Cyclone, it was one which when raging at the surface of the Ocean in the China Sea travelled about at the rate of 12 miles per hour, as by the logs of it which I have; then for three days at 21 miles per hour in the atmosphere; and then after re-descending, at an average rate of 5 miles per hour in the Bay of Bengal, and in the course of its aerial track altering its route from W.  $\frac{1}{2}$  S. to N.  $41^{\circ}$  West. In the change or curving of the track there is nothing remarkable, as we have numerous instances of this, but it seems a somewhat forced conclusion to assume at pleasure these different rates of 12, 21 and 5 miles per hour for the purpose of accounting for a supposed connection between these Cyclones. We can then only note all the data as above, and affirm that our Cyclone certainly descended in the Bay of Bengal, after passing over, or being formed upon some land from which it brought the birds and insects.

#### RATE OF TRAVELLING.

The course and distance between the centre of the 12th and 13th is N.  $37^{\circ}$  West 90 miles only, giving a rate of not quite 4 miles per hour. From the centre at noon of the 13th to False Point is N.  $47^{\circ}$  West,† a little more than the same distance, which it passed over between noon and 11 P. M., so that we may thus fairly set down its average rate for this interval of time, as 8 miles per hour, and this phenomenon of the Cyclone's augmenting its velocity as it approaches the shore is well worthy of note, as in this case it was approaching a low shore with the broad valley of the Mahanuddy river inland. If we compare on our Diagram No. 4, the run of the *Collingwood*, overrunning the Cyclone, with



that of the *Futtle Rozack* clearing it, we shall be satisfied that this augmentation of velocity took place, and moreover, as the *Collingwood's* log may be quite depended upon, we may be assured also that our estimate of the track, if not mathematically true, is so near to the truth that none of the main facts can be doubted.

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### PART III.

#### REMARKS.

Under this head I propose to set down first, short disquisitions on many points of great interest which have been elucidated in this Cyclone, then to give a table of the ships, with remarks on their management or errors, and finally to deduce, so far as we can safely do so, some practical rules for ships approaching or leaving our dangerous Sandheads at the Cyclone seasons.

#### SIGNS OF THE APPROACHING CYCLONE.

Leaving out the swell, which at the head of the Bay at least may be considered an equivocal indication, as the varying monsoons and the heavy discharges of 200 miles of the channels forming the mouths of the two great rivers, the Hooghly and the Burampooter, must often affect it, we come next to,—

#### *The Banks of Clouds.*

These are very distinctly noted in the logs of the *Wellesley*, *John Hepburn* and *Futtle Rozack* on the approaches of the Cyclone, and are noted by others on its leaving them. They were no doubt seen by more of the ships, though not registered at the time. There can be no sort of question however, now, that Cyclones *are* frequently so seen,\* and they will be oftener noted when sailors learn what, in conjunction with other signs, they may indicate. At present unless a peculiarly

\* A recent and a very remarkable instance has occurred to myself. During the Chittagong Cyclone of May, 1849. I distinctly saw and watched for two days from the terrace of my house in Calcutta, say at a height of 50 feet, or of a ship's maintop, the bank of clouds moving from N. E. to S. E. and I was satisfied, from this and other signs, together with the barometrical indications that it was a Cyclone moving down from the N. E. corner of the Bay to the S. W. as it proved to be. Chittagong is 220 miles W.  $\frac{1}{4}$  S. of Calcutta, and had I been at the time in command of a ship bound to the Southward I should thus have had ample time to make all snug, and to consider beforehand what my best plan of management would have been.

remarkable and threatening cloud or bank appears, it is thought little of, and never noted in the log. We should bear in mind too that the same bank of clouds may look most dismal and alarming with the sun and ship in certain positions, while in others it may appear comparatively trifling, and *only* a bank of clouds. The question for the intelligent Mariner should always be, “*is there a bank of clouds in addition to the other signs?*”

The *Wellesley*, *Barham*, *Futtle Rozack* and other ships notice the “dark lurid appearance and the clouds flying in broken masses and thin sheets as if torn from some other mass.” This I also noticed at the time of the Chittagong hurricane referred to in the preceding note.

2. *The Red Sky and Red Light*.—We have fortunately obtained in this instance complete proof, of the most convincing kind, that the red sky and red light occur at times in the Bay of Bengal as a distinct and remarkable appearance on the approach of a Cyclone. I have been unwilling to separate the details of each log as given to me by the Commanders, and thus refer the reader to the *Barham's* at p. 835, the *Wellesley* at p. 837, the *Sea Park* at p. 838, the *Futtle Rozack* at p. 854, and the *British Sovereign* at p. 840, which ship appears only to have seen a red glow at times.

The evidence, however, of the other ships is fully conclusive, and I have moreover the testimony of one of the oldest commanders to this port, Capt. McLeod of the ship *John McVicar*, as to a very remarkable Cyclone, that of the *London*, Capt. Wimble, in October, 1832, quoted by Col. Reid in his *Law of Storms*, in which it was distinctly seen in Lat.  $15^{\circ}$  N. ; Long.  $89\frac{1}{2}^{\circ}$  East ; and also at night ! lasting from sunset till nearly midnight, the sky, and sea, and every object being of a bright scarlet colour !\*

3. *Peculiar brightness and twinkling of the Stars*.—This precursory sign was also very clearly observed and noted by the *British Sovereign* p. 840, the *Chas Kerr*, p. 842, the *Sir Robert Seppings*, p. 844, and *Futtle Rozack* p. I remarked it also very notably at the time of the Chittagong Cyclone before adverted to, as also that the stars were visible at very small altitudes, and I have no doubt that had the sea horizon been visible from Calcutta, it would also have been very

\* I shall in another place give the detailed statement sent me by Capt. McLeod.

distinct, as remarked by Capt. Shire in the China Sea, (*Journ. Vol. XVIII. p. 49.*)

4. *Peculiar Lightning.*—This is also noted in the log and remarks of the *Barham*, pp. 835, 837, and corroborates what we before knew of this peculiar Aurora Borealis or flashing kind of lightning. This appearance is not mentioned by any of the other ships, and it is singular to remark that while some vessels in the Cyclone had no lightning, or but very little, others had very severe thunder and lightning. It would appear that there may be certain zones or quarters of the Cyclone in which alone the electrical discharges occur, so far we can at present judge. Like many other matters, this requires to be better observed before we affirm any thing positively on the subject. I have collected in another section the evidence we have now obtained on this curious point.

*Vibration of the Barometer.*—This remarkable sign we find very carefully noted in the log of the *Barham*; and in that of the *Sea Park*, that the Barometer and Simpiesometer were falling at the time the daily rise should take place.

So far then as relates to the precursory signs of these meteors, we have collected here, from the observations in a single Cyclone, a great number of them, quite sufficient indeed to warn the attentive mariner of what may be at least passing near to him, if not approaching his position, and thence to give him frequently much more time for his preparations,—and time is often with him a question of masts or dismasting—or even of life and death!

#### OF PHENOMENA DURING THE CYCLONE.

##### *Dimensions of the Cyclone and its unequal extent in van and rear.\**

I have already discussed at p. 897, the reasons which induce me to believe that this was a distinct instance of a Cyclone settling down in the middle of the Bay, perhaps after it had been raging in the China Sea, and certainly after it had picked up hundreds of land birds and thousands of insects from some land which it had passed over, and I

\* This word *rear* may sound more military than nautical to merchants, and even to some naval-bred seamen of modern days; but as we have the *van*, *centre*, and *rear* of a fleet, we may with propriety use these words for the artificial divisions of "our enemy," the Cyclone.

now propose to remark on the limited and *unequal* extent to which we can trace it distinctly as a Cyclone.

I have given with the chart two diagrams, Nos. I. and II., of the ships in their positions at noon on the 12th and 13th, with their wind-arrows and the Cyclone circles correctly marked ; as also one, No. III. of a supposed section of the following, or rear, half of the Cyclone in the line of the track which will be subsequently explained. Taking the first of these diagrams, that of the 12th, we find the utmost extent which we can fairly allow it to have reached, as a Cyclone, at noon on that day to the S. Eastward, or on the line of its track, is to the circle marked a little without the positions of the *Barham*, No. 7, and *British Sovereign*, No. 20, or about 90 miles of radius, or 180 miles of diameter. Had it extended farther in this direction these ships, the commanders of which were most fully prepared and anxiously watching for it, would have been hove too sooner, as they were running up towards it at the rate of 8 and 9 knöts an hour. But we see, also, that in front, on the line of its future track, the Cyclone circles distinctly extend to Nos. 10, 14, 21 and 19 or even to Nos. 15 and 11, the four first of which ships had the Cyclone fully commenced with them, while the two last were certainly on the verge of it, and this would give its semi-diameter an extent of 140 miles in front, or 280 of diameter, against 90 in the opposite direction or 180 of diameter. At right angles to the track we have No. 8, evidently without the Cyclone circles, though just approaching to them. We cannot also on this day allow that it reached the Pilot or Light Vessels, but they had evident indications of it, and while No. 15, the *Framjee Cowasjee*, at 170 miles N. N. W. of the centre has a strong and increasing gale from E. b. N. and E. N. E. No. 18, the *Easurain* at 190 miles to the W. S. W. or at right angles to the track (she is not included in the diagram) has a fine N. W. breeze and fine weather, moderating nearly to a calm in the afternoon.

On the 13th again, we perceive by the diagram No. II. that while the monsoon is evidently following up the Cyclone with Nos. 7, 9, 2 and 17, so that we cannot to the S. Eastward allow its semi-diameter to be more than 65 miles, or 130 of diameter in all ; we find that to the North Westward we may without any exaggeration extend the circles, as marked, to the Light Vessel and False Point Palmiras, or to 115 miles, giving a diameter of 230 miles, or about in the same proportion as that

of the 12th. For the extent of the Cyclone on the 14th, as it had then reached the land we have not any data.

We may then take it that we have here tolerably distinct evidence that though the form of the Cyclone was circular, the continuations of these circles were wanting on the following side of the storm disk, and hence we arrive at a solution of the undoubted fact that the latter half of a Cyclone, as calculated from the passage of the centre, seems always to be of shorter duration than the advancing or front portion of it. I have already (*Sailor's Horn Book*,) suggested that this may arise from the disk's not being truly tangential to the earth's surface, but slightly lifted up behind, from the friction of the advancing part against the surface of the ocean retarding its progress.\* Now assuming that a disk is one of 150 miles in diameter and of 5 miles in thickness, we can easily calculate that while the whole 75 miles of the van or advancing portion, if it was moving at the rate of 6 miles an hour, would take  $12\frac{1}{2}$  hours to pass over the ship, a slight inclination of the disk might elevate the following or rear half of it sufficiently to leave say 20 or 30 miles of that part free from its surface action; for an elevation of one mile will, if the whole is projected to scale, be seen to give but a very slight curving upwards to the last 20 or 30 miles of the following side of the disk, so that in such a case the centre of the Cyclone would have 75 miles of the storm disk and its tolerably regular circular winds before it, and only 45 miles behind it; or it would appear to be situated eccentrically on the chart if it was projected according to the winds reported; and if a strong monsoon or trade was blowing behind it this would soon follow and occupy the vacant space between the disk and the earth's surface with its own wind. It is evident that if we multiply the supposed size of our disk, say by 5 or 10, making it 750 or 1500 miles in diameter, and double or treble its velocity, or suppose it to move at the rate of fifteen miles per hour, we shall have a storm disk, which, truly projected on a chart by the logs of the ships, will extend in the same proportions to 375 or 750 miles on its van or advancing portion, and to only 225 or 450 on its following or rear part, and be consequently of so many hours less duration to the ships it may meet with.

\* I am not sure that this suggestion was originally my own, and have some remembrance that it is Mr. Redfield's, or Sir J. Herschell's, but cannot find the reference.

I have given in diagram No. III. the true projection of a section of the following, or rear, half of a Cyclone of 150 miles in diameter, on the line of its track, both horizontally and vertically, to a scale of 10 miles to one inch, to shew the lifting up clearly ; in which the disk on that side is shewn as having lifted itself two miles above the surface of the ocean, and is thus giving to the ships involved in it 75 miles of its fury in front, and but 50 miles in its rear portion ; or to express this in Time ; it is a Cyclone which, if it was moving at the rate of 10 miles per hour would last  $7\frac{1}{2}$  hours in its onset, till the calm reached, and but 5 hours in its decline. If we take our diagram to represent the following or rear half of a Cyclone of 300 miles in diameter, or double its scale,\* as marked on the second line of figures below, we can understand at once how the lifting up of the following part of the disk would much diminish the extent and duration of the Cyclone to the little ships marked upon the diagram, say to 10 hours of time, while those in the advancing circles would have the whole extent of the semi-Cyclone in that direction passing over them, which would require 15 hours.

*Cyclone seen through, at its centre.*

As connected with its extent we may remark here also upon its height, or more properly thickness, which appears to have been very insignificant, perhaps not more than a mile or two, for it will be observed that while the *Edmundsbury* had it at the calm centre "much lighter overhead," Mr. Brackly at the False Point Light House had "the rain clearing off and saw the stars very clear overhead, but a thick bank of haze all round," so that it appears to have become thinner as it approached the land? The *Camperdown* also from 7h. to 7h. 30'. P. M. in the calm had it "fine overhead."

*Hot and Cold blasts, Hail, &c. during the Cyclone.*

Capt. Arrow of the *Wellesley*, it will be seen, noted this phenomenon of alternate hot and cold blasts, comparing the first to the Scirocco. The *Charles Kerr* and *Futtle Rosack* also experienced, if not hail, sleet. These indications are of some importance, inasmuch as hail

\* For the sake of the even numbers : We have 280 miles for the diameter of our present Cyclone, as measured by the advancing circles on the 12th, and 230 on the 13th.

is generally considered to be an electrical phenomenon, and whether it be as a cause or an effect, every electric indication is of importance. *The Storm Wave and Storm Current, and the set over the Sandheads, before and during the Cyclone.*

Taking the storm wave as our first subject of consideration, we find it very clearly described to me by Mr. Brackly, (which I have substituted for his official report from False Point,) p. 849, in terms which leave no manner of doubt that it was a peculiar effect of the Cyclone, and this is more unquestionably shewn when we advert to the time of tide at which it occurred. Had it occurred with the inset of the flood we might have allowed it to have been a tidal bore so common in our Indian rivers.

The fact that it occurred about three hours after the passage of the centre of the calm is at present difficult to account for. We can only note it at present as an apparent anomaly, to be compared with other correct accounts when we obtain them.

But of the storm currents in the Bay, and especially of that setting over the Sandheads, we have abundant proof for all practical purposes, and we can in fact trace it more or less from the middle of the Bay up to the Sandheads, then across them and again to the Southward, as we shall now show from the different ships' logs and Pilots' reports.

The *Sea Park*, which ship hove too, soon after the centre passed her, on the eastern side of the Cyclone, with the wind South, notes from the 12th at 4 P. M. to the 14th at noon, a set of 80 miles to the Northward. This was between Lat.  $18^{\circ}$  and  $19^{\circ} \frac{1}{4}$  N.

Captain Plum, of the *John Hepburn*, states that he experienced a strong current to the Northward; this was between  $17\frac{1}{2}$  and  $19\frac{1}{2}$  N.

But as these two vessels were hove too it might be fairly supposed by strangers that they had under-estimated their drift, but we have the log of the *Collingwood*, which ship was running up with the Cyclone close on its S. Eastern quadrant, and though for a considerable time within the Southerly current off Point Palmiras, yet she has an excess of 31 miles by account to the North of her supposed position in 24 hours, partly no doubt from the storm wave, and partly from the storm current.\*

\* I am enabled to add here from an independent but very trustworthy source, a remarkable instance of the storm current, in the case of the ship *Albion*, Captain

Off the Sandheads we have the log of the *Camperdown*, which ship, even on the 10th, found a strong S. W. current of 3 miles per hour running, with several of the Pilots' reports, though this current is so well known to them at the approach of a Cyclone that they rarely notice it, and as already stated on a trial in the Pilot's Court, which arose out of circumstances occurring at the onset of this Cyclone, it was sworn to by several experienced witnesses, of long standing, that the Westerly current was in their judgment running from 3 to 4 knots per hour, which is independent of the tide. So that if we take  $2\frac{1}{2}$  knots per hour it will not be an excessive average for this current in the parallel of the outer Light Vessel, or  $21^{\circ} 4' N$ .

On the coast we have only the log of the *Sir Robert Seppings*, marking distinctly the Southerly set on the 11th of 2 miles per hour, but it is not necessary to repeat here what I have elsewhere said of the sweep of the current round the shores of Balasore Bay, and past Point Palmiras.

*Barometer as measuring the distance of the Centre.*

Having the places of the centre of the Cyclone pretty correctly marked for the 12th and 13th, I at first anticipated that this Cyclone might afford us some tests to know if the rule laid down by me for ascertaining the distance of the centre of the Cyclone by the rate of fall of the Barometer per hour, would give correct results with one which, as to extent, we call a small, and as to rate of motion a slow-moving Cyclone. Unfortunately, so far as our present knowledge extends, we have no rule within 150 miles of the centre; and our Cyclone does not fairly in any case reach to this extent of semi-diameter except towards the land where the Barometrical indications seem always affected by it for some distance, if the land be not very low. Hence from

McLeod, one of the oldest commanders in the trade between Calcutta and England, who in a Cyclone in October, 1832, (the *London's* Cyclone) ran up from about  $15\frac{1}{2}$  North, on the meridian of about  $89\frac{1}{2}$  East, on the Eastern verge of a Cyclone with "a terrific hurricane" about South; and when preparing to heave to at a safe distance, as they supposed, from the Sandheads, found themselves in  $8\frac{1}{2}$  fathoms on the tails of the Sunderbund reefs, but fortunately beat off. With every allowance Captain McLeod finds that they certainly overran the log about 70 miles in 30 hours!



these two causes I have found that, though with some of the ships the rule would give tolerable results, yet with most it would place the centre very much farther off than it really was ; it being thus, as before announced, difficult if not impossible to judge of the distance of the centre at less than 100 to 120 miles by the rate of fall.

#### DIAGRAM, NO. IV.

This diagram requires a brief notice. It is one on a scale double that of the chart, of the tracks of the ship *Collingwood* running up on the Eastern and North-Eastern quadrants of the Cyclone, and in fact overrunning it on to a lee shore! and losing her masts in doing so ; and of the *Futtle Rozack* crossing in front and making a fair wind of it, while it was dismasting the *Washington Alston*, *Hope* and other vessels which left their pilots with her, or about the same time. On the difference between the management of these ships it is not necessary to remark.

The Barometers of both are marked at intervals of their track, and shew how correctly they measure the approach to, or recession from the centre, though not the actual distance from it. These two ships it will be seen were passing each other at about 75 miles distance, and on opposite sides of the Cyclone, both carrying what sail they could shew, but at midnight 12th and 13th, the *Collingwood*, a first rate English ship, with troops on board, was running in full career into the very jaws of destruction, and the *Futtle Rozack*, a deeply laden rice ship, and a poor sea boat, with a new lascar crew, making her way, as surely as scientifically, into fine weather, without straining a rope yarn.

#### *The Lightning experienced in various parts of the Cyclone circles.*

It seemed of interest to know if we could in this Cyclone deduce any views from the knowledge of this question. I find that exclusive of the distant lightnings before the onset of the Cyclone, the different ships noticed it within the Cyclone circles as follows :—

*Burham* (7).—At midnight 13th, “much vivid lightning,” but during the strength of the Cyclone very little lightning; not more than 3 or 4 flashes altogether, wind about South.

*Wellesley* (8).—On 12th, 8 P. M. to 2 A. M. 13th vivid lightning and peals of thunder, all round and close over the ship, wind West to S. W.

*British Sovereign* (20).—At 10 P. M. 12th, vivid flashes of lightning and heavy thunder to 2 A. M. of 13th, apparently very close. Wind S. W.

*Edmundsbury* (14).—No lightning at any time.

*False Point Light House*.—No lightning while blowing, but during the calm some forked lightning from N. Westward going to the S. Eastward.

*John Hepburn*.—Neither thunder nor lightning.

*Futtle Rozack* (19).—9 P. M. midnight 12th, much summer looking lightning from S. E. to West; and at 10 P. M. 13th, heavy squalls with dreadful thunder and lightning; at midnight moderating fast, wind West to S. W. I made enquiries of most of the Commanders who sent me their logs, but received for reply that there was no lightning or "little to speak of," so that if there had been any of any severity we may suppose we shall have had it noted. All that we derive from this brief summary then is, that a few ships on the South and S. Eastern quadrants of the Cyclone where it was lifting up as we suppose,\* experienced heavy electrical discharges. We must wait for farther knowledge on this question.

#### PART IV.

Table of the ships with remarks on their management.

1. *Brig Teak*—Should have hove to at midnight of the 11th, or by 8 A. M. of 12th till her Barometer rose again.

2. *Joven Corinna*—Was perfectly correct in standing to the Eastward, as the Southerly wind shewed that she was on the Eastern verge of the Cyclone, if there was one.

3. *Enigma*—Ran too close in between the 12th and 13th; she might, if the Cyclone had been travelling up to the N. b. W. or N. N. W. have placed herself, possibly when disabled, between the Cyclone and the lee-shore of the Sandheads of the Sunderbunds; and this uselessly, as she could not have obtained a Pilot or run in with such weather. In other respects she kept safely on the N. E. quadrant of the Cyclone.

4. *Eagle*—Hove too on the right tack and properly allowed the Cyclone to pass her. A stout merchantman or man of war might

\* The analogy of this to the condensing disk of the electrician is obvious, but we want more evidence before we reason upon it.

have carried sail to the N. E. or N. N. E. and soon found finer weather, but a small schooner could do nothing better.

5. *Ararat*—Chased and ran into the centre, though being evidently a good sea boat, and well handled, she escaped unscathed as to masts. though of course straining her hull greatly. She should have hove too at least by 6 A. M. on the 12th, for there could then be no sort of doubt of a Cyclone, and it is quite useless, if not dangerous, to get close in with Point Palmiras or the Pilot station in such weather.

6. *Flora Macdonald*—Like the *Eagle*, was hove to on the right tack, and could do no better, being close in to the Eastern shore.

7. *Barham*—Perfectly well managed, heaving too at the right time and in the right place, and did not strain a rope yarn!

8. *Wellesley*—The same masterly management as the *Burham*.

9. *Sea Park*—The same. She was at the centre when it settled down, and though as it passed on it gave her, being on the Eastern side a Southerly gale, yet she very properly hove to till it was safe and proper to run on, so as to come into soundings in moderate weather.

10. *Asiatic*—Had the wind at N. E. at noon with every indication of a Cyclone to the S. E. of her, and the known tracks being almost invariably from that quarter. If like the *Futtle Rozack*, close to which ship she was, she had run to the S. S. W. and hauled gradually up, so as to run round the heel of the Cyclone, she might have escaped the severe part of her smaller Cyclone, and the risk of being dismasted while drifting on a leeshore.

11. *Sir Robert Seppings*—This ship's Barometer, standing high, the frequent treacherous moderating of the wind, and perhaps the desire to obtain a farther offing, led her to stand to the Eastward till she placed herself exactly on the track of the centre. She should have bore up to the South between 10 P. M. and midnight of the 12th, and have run round "under the stern" of the Cyclone, when she would have recovered her Northerly position, unscathed, by about the time at which she was dismasted!

12. *Camperdown*.—At noon of the 12th, was standing to sea being 15 miles S. S. W. from the Pilot vessel. Her case and the course she should have adopted is exactly that which will be supposed in the next section, but with the difference that she had far more time and room to run down and cross before the Cyclone, since it was 19½ hours before the centre reached her.

13. *Collingwood*—This vessel's management in contrast with that of the *Futtle Rozack* has already been examined. It is evident that her rapidly falling Barometer from noon 12th, and S. E. b. S. gale; at 10 P. M. were indications of a Cyclone to the S. W. of her, which according to the known tracks would be travelling up between North and West or N. West, and that her safe course was to haul out for a few hours to the N. Eastward before the sea was too heavy and till her Barometer rose, and then heave too on the starboard tack, so as to have had the gale always drawing aft, a clear drift, and the pilot station well open to her, whether the Cyclone was to be followed by Southerly or by N. Easterly winds.

14. *Edmundsbury*—The Pilot stood to sea at 6.30 P. M. on the 11th, he had consequently abundant time to cross in front of the Cyclone, if he had known or could have ventured to have adopted this plan, which I shall shew at the conclusion of this memoir is almost always the safe one, and that moreover no distance or time is really lost by it.

15. *Framjee Cowasjee*—The error of the Pilot on this vessel is exactly that of the *Edmundsbury*. Fifty miles to the S. W. would have saved her masts, and have given her a N. Westerly and S. Westerly gale, to cross in the wake of the Cyclone and run in again in the fine weather, without straining a rope yarn.

16. *Washington Alston*—A. M. the same error of standing to the S. Eastward, and the same dismal penalty paid for it, in loss of masts straining of hull, damage of cargo, and a long tedious drift of *thirty seven days!* about the Bay, in light winds and calms, in a disabled state before she could get in again.

17. *John Hepburn*—This little vessel was bound to the Eastward and was one of those caught by the descent of the Cyclone in its central space about noon of the 12th. She had the warning of her Barometer falling on the 11th to 29.50 and A. M. of the 12th to 29.38; but up to nearly noon of the 12th when the Barometer had fallen to 29.25 and the Cyclone by passing on had given her its S. E. gale with which she was drifting till the 13th, when it gradually left her, she had no wind to indicate to her whereabouts the centre might lie, and in the S. E. gale a small vessel could not risk standing off to the N. Eastward.

18. *Easurain*—Had passed well to the Southward before the Cyclone settled down.

*The Ship Forth* was capitally well managed, though from compulsion of circumstances and not by design; she was ordered to sea from the Pilot and spoke the *Camperdown*, and being leaky and unmanageable kept before the wind, ran round the Cyclone, being at one time very close on the centre, and was in a good position for coming in again to repair when the weather moderated!

*The Futtay Allum* evidently ran into the Cyclone on its Western and S. Western quadrant till near the centre, when its violence obliged her to heave to, and she seems to have drifted up with the S. Easterly hurricane, and with the storm wave and current, into soundings, disabled and partially dismantled.

19. *Futtle Rozack*—I have already quoted the admirable management of this ship.

20. *British Sovereign*—Like the *Barham* and *Wellesley* was excellently managed, heaving to at the proper time and place, and escaping all damage.

21. *Charles Kerr*.—This ship necessarily stood off to get an offing, but when she had done so, at noon on the 12th, she should have put her helm up and run to the S. W., till the N. Westerly gale of the S. W. quadrant of the Cyclone, and her rising Barometer, shewed her it was safe to haul round the heel of the Cyclone, or time to heave to avoid running up again too early.

The statistics of this Fleet, for such it was, may be well worth summing up. We find, then, that we have in the twenty-two vessels, the *Easurain* having altogether passed over the Cyclone tract before it descended, the vessels as follows:

|                                                                      |   |
|----------------------------------------------------------------------|---|
| At a distance from the Cyclone but well managed in anticipation      |   |
| of it, .....                                                         | 2 |
| Ran in too far before heaving to, .....                              | 2 |
| Suffered more or less but unavoidably so, .....                      | 1 |
| Running into, or with the Cyclone, or lying to in the way of it, but |   |
| escaping with only severe straining, .....                           | 5 |
| Dismasted by running, or standing into, or chasing the Cyclone,      | 5 |
| Perfectly well managed by their knowledge of the Law of Storms,      | 6 |
| Well managed from necessity, .....                                   | 1 |

We have to add to this that seven ships and brigs, exclusive of coasting craft are known to have foundered, whether from mismanagement or bad condition, or under unavoidable circumstances, we cannot say, and that the ships *Collingwood*, *Camperdown* and *Sea Park* had on board 733 men, 11 officers, 46 women and 41 children; altogether 831 souls; of H. M. troops, which we may fairly call a whole regiment; two thirds of which, i. e. those on board of *Collingwood* and *Camperdown* were exposed for a time to imminent risk. There surely wants nothing more than this to convince the most incredulous of the deep importance of our science to both public and private interests?

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PART V.

*Practical deductions for the Management of inward and outward bound ships, at or nearing the Sandheads, when a Cyclone is approaching.*

The great objects of all these researches are, first to develop the laws by which Cyclones are governed, and then from such laws to deduce rules for every special class of cases whereby life and property may be rendered more secure. In no part of the ocean are such rules more required than at the difficult access to the mouth of the Hooghly; and in no part, as far as I recollect, is there to be found a more perplexing combination of dangers at the approach of a Cyclone. I have long contemplated the task of unravelling this complicated network of perils, but I have felt, hitherto, that our data were too insufficient to enable me to speak with confidence on many essential points, and to illustrate what I might say with undoubted and striking examples. In a word, if I may be excused the phrase, "*we wanted a good Cyclone with plenty of ships involved in it to give us some clear and startling lessons,*" and I trust, now that we have had one, the foregoing pages will prove that I have done my best to turn to account the materials which have been so liberally furnished, and that I shall not be found to have set down these rules without duly weighing the heavy responsibility of doing so.

Let us consider what are the various dangers in a Cyclone to a ship at (within) or near the Sandheads where they invariably commence from between N. N. E. to N. E., East or S. E.

1. The sands forming a lee shore from the Western Brace to the mouth of the Burampooter, with narrow channels and indifferent holding ground, and a sea in which no ship can hope to ride with safety in a severe gale.

2. The land to the Northward and Westward, and from Point Palmiras to the Southward.

3. The heavy set to the Westward over the sands, and for some distance outside of the tails of the reefs.

4. The Cyclone itself, with its uncertain track, and its attendant storm-wave and storm-current, one or sometimes both, setting on to the sands or to the coast about Point Palmiras.

It is evident that in every Cyclone these four conditions must be all taken into account; and as there is now no sort of doubt about their rotation, the usual tracks of the Cyclones become the next consideration, for it is upon the track of the Cyclone and its rate of travelling that the safe application of any rule must mainly depend. From all our investigations up to the present day it appears, that at the Sandheads, and from thence to  $8^{\circ}$  or  $9^{\circ}$  North, the tracks of the Cyclones may be from between E. by N. and S. by E., or S. S. E., to the W. by S. or N. by W. or N. N. W., and as will be seen by the Chart of tracks in the Horn Book that the average may be about from the S. E. or S. E. by S., to the N. W. We can only lay down rules from the average, noting where they would be affected by any great deviation towards the extremes.

The rate of travelling is the next consideration, and this too varies very much, though it probably seldom exceeds ten miles per hour, which we shall also assume as an average.

Taking, first, the inward-bound ships, whether from Madras, from Europe, or from the Eastward, we have to consider their position, and then if the Cyclone is ahead, or astern, or abreast of them, and in what part of the Bay its centre may be, for it is clear that all these cases will vary as this element also may vary.

The first case in which the Cyclone is ahead of the vessel, or in other words the ship is behind the Cyclone, is simple enough: when convinced of its being a Cyclone, the rule should indubitably be to heave to, and this on two accounts; the first to avoid running across, or into the centre, or overtaking it, and the second because, even if a

vessel got safe through, or past, the centre, she would not gain an hour of time on her voyage, since, as we see in many of the foregoing logs, she would on reaching the Pilot Station be ordered to sea, or if the Pilot Vessel had been blown off the station the stranger might find herself hampered off the Reefs or Braces, with 24 hours of heavy weather yet to go through, on a lee shore ; the Cyclones always ending at South, or S. W.

The case in which the ship is *abreast* of the Cyclone, which we may describe as having the wind North or South blowing a gale, with a falling Barometer, so that the centre bears East or West of her, is a double one. If the wind is South or between S. E. and S. W. it is clear that the ship is also safely to the Eastward of the Cyclone, and has only to heave to, if she has not a long run to make to the Sand-heads. She will of course heave to on the starboard tack, being on the right hand side, till her Barometer rises ; or if it be judged, say by the violence of the S. E. squalls and the fall of the Barometer, that the centre will yet pass close to her, to stand off to the N. E., unless indeed the vessel be altogether hampered in the N. E. corner of the Bay.\*

If however, she has the wind between N. E. and North, it is clear that the Cyclone is to the Eastward or S. Eastward of the ship, and is perhaps coming direct towards her at the rate of ten knots an hour, and she must now run back to cross in front of it ; always remembering that every mile she runs, say to the S. S. W., after she has brought the wind N. N. E., is into safety, as her rising Barometer will quickly show. The reason for this is obvious ; she avoids the centre and avoids the farther danger of being hampered, with perhaps a disabled ship, between the Cyclone and the heads of the reefs or the coast of Orissa, as may be. She may always, as she brings the wind to the Westward of North, haul to the Eastward and *run round* the Southern quadrants and “under the heel” of the Cyclone, so as really to lose no time while running easily before it,† or with a quartering gale, so as to avoid the racking and straining of heaving to, or of carrying sail off a lee shore or riding it out when dismasted.

For the outward-bound ships it is clear that, supposing them to leave

\* I always assume sea room as this is necessarily the sailor's first consideration.

† As in the case of the *Fortk*, just quoted, which though a forced manoeuvre, was successful, and shows what may be done by a ship which steers well though in distress.



the Pilot at the commencement of the Cyclone, or to meet with its onset a few hours after getting to sea, say in  $20^{\circ}$  North, their rule must also be the same, namely, to bear up so far as to cross in front of it, and not, which has usually been done, to stand close hauled into the very path of the track.\* And recollecting that from False Point the coast trends to the Westward of S. W., and that in  $20^{\circ}$  North on the meridian of the Light Vessel, a ship is still 120 miles from the Black Pagoda, there need be no fear about making a little Westing at first, for allowing the Cyclone the very worst track we can suppose for a ship in this position, namely, one from S. by E. it is clear that a very short run to the S. W. will place the vessel at a distance from the line of the track and bring the wind to N. N. E. and gradually to North, so as to place her abreast of the centre; and if the track is from any point more Easterly, as it probably will be, say from S. E. or E. S. E., then the distance to be made will be but short to a Northerly wind. The intelligent mariner may easily by means of a storm card see the truth of these propositions.

For the set over the Sandheads it may be safe to allow three and a half miles an hour at the onset of a Cyclone, at the *Light Vessel*, decreasing to two and even one knot by the time the vessel has passed the parallel of  $20^{\circ}$ ; but also increasing both in breadth and velocity if the Cyclone has lasted any time, and the careful mariner will duly take this into his account, whether standing out or hove too.

We may further illustrate this by a reference to our Diagram, No. I., upon which we will suppose, to put things almost at the worst, a Cyclone like this of October, with its centre on the position marked for that of the 12th in Lat.  $17^{\circ} 48'$  North, Long.  $89^{\circ} 18'$  East, coming up on the same track towards False Point, but at the rate of *ten* miles an hour. This will place it in twelve hours about 20 miles ahead of the spot at which the centre of the 13th is marked, or say in Lat.  $19^{\circ} 17'$  North, Long.  $88^{\circ} 18'$  East, and leaves still a distance of something more than 80 miles between its centre at midnight and False Point. Now, though ships would probably be ordered to sea, say by the station vessel (lying outside of the Light Vessel) on the 11th, and certainly at daylight on the 12th, we will suppose a vessel so beleagued, or to have mistakenly run in so far, that she can only start from

\* No doubt to make Southing and to get an offing from Point Palmiras.

the Light Vessel at noon of the 12th, so as to get 100 miles of run before midnight. It will be seen by taking this in the compasses that steering to the S. S. W. and S. W. by S. it will take her between the Point and the centre, and at a distance of 45 or 50 miles from this last, and then enable her to bear away to the S. W., so that she will quickly run into the moderate weather, and can gradually haul up to the Southward, Eastward, and Northward back to the Light Vessel again, if the weather is fine enough. Every seaman will of course see that this is a question of rate of sailing, and above all of steering so as to avoid broaching to; but that even if he should be disabled (which he might equally be in lying to) he will still here have Northerly winds and a clear drift to sea, while on the Northern side of the Cyclone track he would be drifting on to a lee shore with Easterly and S. Easterly winds. The examples of the *Forth*, which vessel I take to have been at one time within 20 or 30 miles of the centre, and of the *Collingwood* while overrunning the Cyclone, are instances of what may be done by good steering ships even in the very height of these fearful tempests and close to the centre, and the *Fattle Rozack's* management is a good instance of passing a Cyclone at a reasonable distance with a heavy sailing ship.

In some instances, as in the Coringa Cyclone of Nov. 1839, which forms the subject of Part II. of my second memoir (Journal Asiatic Society, Volume IX.) it has occurred that a Cyclone travelling from the Andamans to Coringa was so far felt as a heavy Easterly and E. S. Easterly gale at the Sandheads, that for some days it was imprudent to approach the station, and all vessels were warned to sea. But in this and all similar cases of distant Cyclones the Barometer is the guiding indication, and in this instance the Barometer was at 29· 92' to 29· 95' at the Light Vessel.

In my third memoir, also (Journal Asiatic Society, Volume IX.,) we have an instance which might appear to create a difficulty, *i. e.* a Cyclone travelling across the Bay from the Andamans, first towards the Coromandel Coast, on about a N. W. by W. course, or towards that part of it lying between Ganjam and Bimilipatam, but on its approach to about the Meridian of the Light Vessel curving to the N. W. by N., so as to "land" between the Black Pagoda and Juggernaut, giving the Light Vessel and ships at the Sandheads a heavy Easterly and

*E. by S.* gale, amounting at one time with some of them who were close to False Point or on the parallel of  $20^{\circ}$  to a hurricane.

But in this case also there will be found abundant guidance for the judgment of the attentive seaman, who will see by placing his Horn-card on the Chart, that the wind at the Light Vessel is at *E. by S.* (shewing that the centre is *S. by W.* of him already) from the first, and *E. S. E.* (centre bearing *S. S. W.*) by the time it is really blowing hard, and thus he will not attempt now to cross in front, but get an offing and heave to.

To sum up these rules then. For the ships to the Northward (*i. e.*, on the right hand side of the track) of the Cyclone when the gale, with a falling Barometer, is at *S. E.* to *E. S. E.*, they may if they have sea room stand to the *N. E.* to allow it to pass them comfortably, heaving to of course on the starboard tack when far enough out of its way. Between *E. S. E.* and East they may, if the Barometer be not too low and they have sea room to give the shores of Orissa a wide birth, with a stout ship and good helmsmen venture to cross, or if this be not advisable, heave to on the starboard tack when they have made an offing, if in an outward-bound ship, or before they run too far in if inward bound.

With the wind between East and *N. E.* to North. I have already shewn that crossing may almost always be safely adopted for the ships to the right (Northward) of the Cyclone path; and for those to the left (Southward) of it that they must not run into it fancying it a fine fair wind, or too far up if in its rear, as that is wholly useless, and may bring them into soundings with a heavy Southerly gale, and this much sooner than they expect, if the storm-wave and current are strong when the track is one near the Meridian.\* All will, I hope, recollect that they have first to consider what their ship and crew can do, next what their best course is, and lastly in what position they may be if dismasting, or even loss of topmasts should occur; and this may happen from broaching to, or from sheer hard blowing, in the best ship. With an on-shore gale the resource of anchoring in the open ocean, which all the Sandhead anchoring, and most of that of the coast of Orissa is, becomes one to which no good seaman would desire to be reduced if he can avoid it.

Finally; I need not remark that in all this, both as to the expected

\* See the case of the *Albion* in Note at p. 905.

Cyclone and what is to be done to avoid it, much must depend on the judgment guided by careful observation. Thus for instance a sea from the Eastward, crossing a Southerly one, with a bank of clouds to the E. S. E. are strong signs of a Cyclone, though it may be blowing fresh from the South at the time ; and again if the bank is heavy to the S. S. E. that it may come up from that quarter. In a word, the vigilant seaman will watch every thing and despise no indication, and the dull and the careless will see nothing and be always too late ; and then it will be said that "the ship was very unfortunate ; but the under-writers have paid the damage, and the Captain, poor fellow, has lost his command !"

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*Description of a Colossal Jain figure nearly 80 feet high, cut in relief, discovered on a Spur of the Satpoorah Range, in the district of Burwanie, on the Nerbudda.—By Dr. IMPEY.*

(Copy.)

*From E. IMPEY, Esq. Residency Surgeon, Indore,*

*To Sir H. M. ELLIOT, K. C. B. Secretary Foreign Department.*

*Dated Residency, 30th October, 1849.*

SIR,—I have the honor to submit through you, for the perusal of the most noble the Governor General, a report on, and drawings of, a remarkable object of antiquity,—a Colossal rock image cut in relief, and nearly 80 feet in height, situated on a spur of the Satpoorah range, in the district of Burwanee, on the Nerbudda, about 100 miles from Indore.

2. As the image is, I feel assured, of considerable interest, being the largest figure of the kind known in India, and second only in magnitude to the Bhuts at Bamiyan, and has never been described, I have been at some pains to do so fully, and also been particular in the translation of the inscription found in the reconstructed temple connected with the worship of the image, both of which are of the Jain persuasion.

3. I have reason to think from the character of a separate inscription found by me, that others may yet be discovered of more remote date than Summut 1223, A. D. 1167, which is however of so much value that it accords with, and fills up, a blank in the dates of some

Jain temples at Woon, also visited by me recently, and of which I am preparing a notice in conjunction with the Budhistical caves of Bang, of which a very imperfect description exists.

4. Should I be able to accomplish this object in the ensuing cold season, there will be left of the *known* remains of the Budhists and Jains in central India, the caves of Chundwassa, adverted to by (Col. Todd) alone that need detail.

5. For the drawing which accompanies this report, I am indebted to Lieutenant Macbeen, of the 74th Regiment, now at Mhow.

I have, &c.

(Signed) ELIJAH IMPEY,

*Residency Surgeon.*

*Indore Residency, the 30th October, 1849.*

(True Copy.)

H. M. ELLIOT,

*Secy. to Govt. of India with the Govr. Genl.*

*From W. GREY, Esq. Foreign Secretary to the Government of India,*

*To the Secretary to the Asiatic Society,*

*Dated Fort William, the 15th December, 1849.*

*Foreign Department.*

SIR,—I am directed by the President in Council to transmit to you, for communication to the Asiatic Society, the accompanying letter from Dr. Impey, Residency Surgeon at Indore, regarding a Colossal Rock Image in the Satpoorah range, together with the report, drawings and inscriptions connected with the same.

I have the honor to be, Sir,

Your most obedt. Servant,

W. GREY,

*Foreign Secy. to the Govt. of India.*

*Fort William, the 15th December, 1849.*

It was with some reluctance that in giving a title to the subjoined description of a very remarkable and interesting relic of the Jain faith and religion, now for the first time brought to public notice, I applied the word discovery, which is perhaps in many senses more suitable to a scientific deduction, but being assured by those most competent to give an opinion that priority of announcement is generally

held to be decisive of priority of discovery, I had less hesitation in using so ostentatious a term, particularly as it is becoming apparent from the announcements made almost daily, that there yet remain very many records of sacred and architectural antiquity unobserved by us, but matters of notoriety to every native around, and undivulged from no desire of concealment, but either from the apathetical habit of the natives in general, or their excessive reserve in speaking of religious subjects, upon which they are usually unwilling to originate a conversation.

The value and importance of the figure brought to light, and which may be most aptly termed a rock image, I have no desire to estimate unduly. I dare say those interested in these pursuits, will glean from the following description all that is deserving of record and worthy of confidence in an antiquarian sense. I must content myself therefore with stating in this place, that the chief Colossal figure is not a statue, but a naked image cut in high relief out of the side of a hill of amygdaloidal trap, in the same manner and similar to the Bhuts at Bamiyan, and its full height must be ninety feet, at least that portion above ground, viz. about a foot below the knee, measuring seventy-two feet, eight inches; and I believe it is, with the exception of a few figures, between thirty or forty feet high in the fort of Gwalior and one near Kussia,\* the only one of the kind as yet known between the Himalayas and Cape Comorin, differing from those at Bamiyan, in being naked, and from those at Beligula, Einur and Kurkal in Canara, in being essentially a rock image cut in relief instead of being sculptured as a statue; other points of comparison will be noticed in detail, my only fear is that in the hurried visit of a few hours which I was enabled to make, many subjects which might have been highly useful both in an historical and theological light have been left unnoticed or touched too lightly upon.

My notes were taken as far back as 1846, when I was stationed at Mhow with a troop of Horse Artillery, and should have been given

\* In the Journal of the Asiatic Society Bengal, for June 1837, there is a colossal image described under the vulgar appellation of Mata Kooar; it is situated near Kussia in the Gorakpoor district. The height, though referred to in the report, is not stated, nor a sketch of the figure lithographed, but Mr. Prinsep, in a note, regards it as an image of *Bhoddha*.

publicity to sooner, but just as I was arranging them, I received my appointment to the Residency at Indore, and I was in hopes that I should ere this have had an opportunity of adding to, or correcting my first impressions; illness and other causes have however arisen to prevent this and I now furnish them with not a little diffidence.

It was on the occasion of my return from an excursion to the undervalued and imperfectly described caves of Bang, the extent and beauty of which however I hope to shew in a subsequent report (having been fortunate enough to discover few large Vehars, and several small detached caves, for the daghop only, and not chaitya cathedrals—anomalies I believe in Bhoodhistical excavations), when it was casually suggested to me to visit the Bawunguj. This proved to be the general acceptation of the height and the current name of the colossal figure, the chief subject under consideration.\* It is situated in Burwanie, a considerable district in Kimar, on the left or south bank of the Nerbudda, under the chieftainship of an independent rajah, who has just obtained his majority. The capital of district is also named Burwanie, a few miles west of which run the first spurs that the Satpoorah Range sends off towards the Nerbudda in a north westerly direction. About seventeen miles further down they close in and meeting others from the north bank of the Vindhyan chain, form the

\* Literally 52 guj. If we reckon the guj here alluded to, to be that in ordinary use on this side of India, viz. Malwa, viz. 30 inches, and we are bound to accept this standard in preference to the English guj or yard, which is chiefly used in cloth measure, and could only have come into general adoption with the extension of our power; and before that period the name in all probability had been given to the figure; we should have a supposed height of 130 feet to it. With its pedestal, if it has any, it could not have extended to this, nor does it approximate in any degree to my measurement of 90 feet 10 inches; but the standard of 30 inches is not an approved or legitimate one, and the only one I am aware of that is, is the Illahie guj, of the Emperor Akbar, fixed by him at 41 fingers, and determined by Colonel Hodson, late Surveyor General in India, (*Transactions Asiatic Society*, Vol. 7,) from several measurements of the Taj Mahul and other Mahomedan buildings to be 31 inches and a fraction more than one-third, which would make the Bawunguj 134 feet 7½ inches, a height utterly inconsistent and extravagant. I mention this, not that an approach to accuracy is likely to result from any hypothesis that could be drawn from a mere name, yet it is as well always to endeavour to test the statements of natives, particularly if traditional, to ascertain if there are any real grounds for their appellations though ever so common or unmeaning.

celebrated rapid called from its conformation the Hurnpahl or Deer's Leap.\* The hills as they stretch toward the river present sharp defined outlines, and are crowded and heaped confusedly together, their summits for the most part terminating in peaks or sharp ridges, and rise from 14 to 1700 feet above the bed of the river, which at Chickulda, on the opposite bank, is 550 feet above the level of the sea; thus giving an extreme elevation of at least 2000 feet to the sacred peak, which is by no means the highest visible.

It is upon the east face of one of these hills, about 3 miles from Burwanie itself, distant upwards of four from the Nerbudda, that the Colossal figure is cut.

About a mile from Burwanie the first ascent commences, and from hence to the summit, is fully two miles of a most laborious, and in the hot season most fatiguing way, for there is neither shelter, stream, well, or tank to refresh the traveller. Colonel Franklin's description (in *Transaction, A. S. Great Britain and Ireland, Vol. 1st*) of the ascent to Samet Sikhara in Behar, is so applicable to that of Bawunguj, that I cannot forbear quoting it:—"The ascent, he says, commences by a narrow path in a winding direction, surrounded on both sides by the thickest forest. It is steep, with loose stones overspreading the road; as you proceed the ascent becomes steeper, and the summit of the mountain presents a stupendous appearance; no animal of any kind is to be seen. The ascent still continues and the forest begins to thin, &c. &c. and after some difficulty the summit is reached, from which is an inexpressibly grand view of what may here also be termed the jungle tarai on one side, on the other the Nerbudda stretching far and wide its alluvial banks, luxuriating in the most fertile vegetation.

It is after you pass the tabulated surface of the lower hill, and immediately at the foot of the steeper one, that the first appearance of "holy ground" presents itself, consisting of a small figure of Parswinath, seated in an enclosure, and in front of it a rude square pillar resembling a dipmahl displaced, unused and almost fallen down.

\* Sir J. Malcolm, in his *Central India* thus describes this rapid. "The name of the Hurnpahl is derived from the circumstances of the river being here obstructed by large masses of basalt, rising about 10 or 11 feet above the ordinary level of the stream, and giving passage through three very small channels, across each of which it is supposed an antelope could bound."



There are figures of the same kind but neglected, all around. The chief object, viz. the colossal figure and temple, being still much further up the hill, I could not stop to examine these minutely.

Few other traces of the proximity of the great divinity were perceptible until a rather sharp turn brought you literally upon heaps of statues, some 12, some 5 feet high, erect as well as seated, quietly ensconced each in his own secluded retreat. Opposite to these, on the bare hill side, was the great colossus himself.

The drawing\* will perhaps give a better idea of the figure than any description; it is reached with some difficulty, owing to the large boulders and blocks of stone that have fallen down from above. As will be seen, it is Digambaree, and stands quite alone, almost in full relief.

The Deity seems in mental abstraction, as if undergoing "*tapasya*." The countenance is particularly placid and contemplative, and the figure presents generally the appearance of composure or repose, with the hands by the side. The earth and rocks that have fallen at the feet make it appear buried nearly to the knees, and detracts from its real height. It has no canopy, but on either side of the head some masonry of later workmanship evidently than the figure itself. That on the left is evidently brick work, meant perhaps to rectify and square the unevenness of the niche from which it is chiselled; on the right, handsome stone brackets act as supports to the recess. The hill being almost perpendicular, I was unable to make an accurate hand measurement, and had not the instruments to observe one; the only course left to me therefore was to send my guide round to the top of the hill, and from the crown of the head of the figure to make him let down a chord I fortunately had with me, to the ground, and as he did so, to leave marks or knots at the different places I indicated to him, such as the knees, pubes, &c. &c.; by this means I obtained a measurement as accurate at least as circumstances permitted. The extreme height to the buried part I find to be 72 ft. 8. in. The different proportions as follows:—

|                                                  |               |
|--------------------------------------------------|---------------|
| 1. From below the calf to the Patella, . . . . . | 11 ft. 18 in. |
| 2. To the extremities of the fingers, . . . . .  | 6      8      |
| 3. The wrists and os pubis, . . . . .            | 8      9      |
| 4. The umbilicus, . . . . .                      | 9      9½     |

\* This will be given in a subsequent number.—*Eds.*

|                                      |    |               |
|--------------------------------------|----|---------------|
| 5. The axilla,.....                  | 11 | 11            |
| 6. The shoulders and clavicles,..... | 4  | 1             |
| 7. The chin, .....                   | 5  | 0             |
| 8. The ala nasi,....                 | 4  | 10            |
| 9. The droop of lower eyelid, .....  | 2  | $\frac{1}{2}$ |
| 10. The arch of eyebrow, .....       | 2  | 2             |
| 11. The root of hair, .....          | 2  | 9             |
| 12. To the vertex, .....             | 2  | 10            |
| Total, ..                            |    | <hr/> 72 8    |

From the os pubis to the vertex being usually reckoned as one half the body, and that being in the figures 45 ft. 5 in., the extreme height should be 90 ft. 10 in.\* and that portion of the body below the calf now under ground, according to the same calculation, should be 18 ft. 2 in. The proportions are however by no means sculptural or in unison with the above standard ; for instance, from the lower part of the knee† to the foot, or  $\frac{1}{4}$  of the whole body, in the figure however it is only 15 ft. 5 in. instead of 22. 8 ; this would only give a height of 61 ft. 8 in. whereas 72. 8 are above ground.

Again, as will be noticed at a glance, the head is very much out of proportion ; properly it should be equal to  $\frac{1}{4}$  of the whole body, but as it measures in the figure 14 ft. 9 $\frac{1}{2}$  in. this would give a height of 119 ft. 4 in., and there are other disproportions which at once strike the observer, namely, the shortness of the neck, which is but two inches less than from the chin to the ala nasi, the squareness of the shoulders, and the closeness of the axilla to them.

The abdomen and right breast are much worn away, and the left thigh and right and left fore arms also mutilated, owing to great masses of trap boulders that have evidently been detached in consequence of the decomposing nature of the rock and its exposure ; green earth envelopes these boulders. The rock here is a good deal broken, which might lead to the inference that the figure must have been meant to be

\* In confirmation of the accuracy of this measurement, a pundit, whom I sent up, took the measurement in some way not stated by him ; but he gives the height above ground 52 cubits, or 78 feet, and guesses that under ground 8 cubits more—i. e. 100 feet in total.

† To the bottom of the os pubis ought to be the same as from the knee.

clothed or Swetambaree, but there is no trace of an ornament, belt or clothing upon either the body or limbs, or between the latter, except the breast, which has a quadrated lozenge marked on it. The ear-rings reach to the neck, which is cut in wrinkles; the face is pretty perfect, with the exception of the nose, which appears to have been jointed on.

If we accept and regard the Bhudhistical estimation of beauty, we shall see little to quarrel with in this or other kindred figures, for hair, expanse of forehead and face, roundness of head, elevation of the nose and arched eyebrows, are, Mr. Hodgson tells us, among their thirty-two discriminating points. The figure is naturally coarse to investigate closely, but the *toute ensemble* is imposing. There was no trace of inscription any where.

In a small recess facing the great image, and a few paces from it, there is an upright figure of solid stone surmounted by a circular canopy which projects over it. It has three retiring borders, decreasing in circumference, and leading to a kind of dais, on the upper or flat surface of which a smaller figure is seated cross-legged. The arms are not on the feet, but hold a sort of pillow, which rests on the knee, or in the lap of the figure, and sometimes behind it. I scarcely knew whether to call this the *sabeit* or lacquered basket, one of the requirements of the Jainas, and which is round, or in reality a pillow, but the position of it behind the image sometimes is decisive of its being the *ghadee*. On either side of this small figure are elephants, each holding in their trunks an inverted Lotah, their feet resting on the lower margin of the canopy. Viewed in front the canopy has a festooned support. It is quite plain on the under surface, and without a fringe, and about a foot above the hair of the chief figure, which is like all Jain and Bhudhistical statues, short, curly and raised slightly, similar to a wig, and carried back straight to the ear. At the back of the head is the lambent flame of sanctity, for which Budhistical figures are also remarkable. On either side of this statue, parallel with the neck on the outer part of the tablet, are attendants, their heads circled with a small *mughut*, and holding wreaths in both their hands; their attitude is similar to those on the sides of the Daghop, at Karlee, and in the Keneri caves, that of flying; the outside one is a woman, the inner clothed, kurra or bangles on their arms and ancles; round the neck, arms and body a multiplicity of chains or the convolutions of one. I look upon this as

a mere ornamental chain, common to attendants, for the Zennar or Janwi is seldom if ever seen in Bhudhistical sculptures, neither is it worn in this way in brahminical ones ; and the Jains in their rules for the very first class of ascetics "anuvrata," which are less stringently dealt with than the higher orders, enjoin the Janwi to be thrown away. Plate 14 of Moor's Pantheon of Mahadeva in the act of destroying Tripaisura, has a like arrangement of the chord. It is however worn by attendants only, and there are two others similar to the above, with the exception of bangles. They are immediately below the hands of the chief figure, which touch their head-dresses ; these head-dresses, like those of all figures attendant upon the Tirthankus of this locality, are peculiar, being spiral, with two, three or more coils or rings upon them tapering to a point. The nearest hands of the attendants rest upon a stone support, a kind of mace, or may be conch, with three convolutions ; of this I am not quite sure ; their lower halves as well as that of the chief figure, are in the ground. The outer part of the tablet by the arms of the chief figure is plain and not ornamented. The eyebrows differ from most images of Bhudh in general, in being turned up at the outer corner, the eye the while denoting repose, being prominent, but fully one half covered by the upper lid ; the nose is beautifully formed in shape and proportion, displaying a very favorable contrast to those given to Bhudhistical figures, upon which however Jain sculptures seem to have greatly improved. The lips project, the lower one especially, and is very angular ; the chin is dimpled, and the cheek rounded, but the face is remarkable for breadth, being 2 ft. 5 in. from ear to ear ; the throat has 3 zones or creases round it, and on the breast is an expanded lotus, with 8 smooth edged petals enclosed in a lozenge. The nipples are traced ; the belly projects in the least just below the umbilicus, which is indented ; the thighs are round and prominent ; the gastrocnemii in proportion, and approach one another, but the image is unfortunately buried beyond this. The length of the arm, from the shoulder to the extremities of the fingers, is 4 ft. 6½ in., the latter are in excellent proportion, and turn towards the thigh. The figure is beautifully rounded, and the sculpture is altogether of the most finished workmanship, and in point of art and symmetry very perfect ; too much so to be otherwise than modern. There are unfortunately of this figure but 10 feet above ground, and no more than 12 inches below the knee are

visible. If, as before, we consider the head equal to  $\frac{1}{4}$  of the body, according to sculptural proportions, it would give a height of 12 feet or more, or taking the arm as 3 heads, 13 ft.  $6\frac{1}{2}$  in.

|                                 |       |                          |
|---------------------------------|-------|--------------------------|
| From summit of hair to chin, .. | 1 ft. | 6 in.                    |
| From chin to clavicles, .....   | 0     | $3\frac{1}{4}$           |
| Clavicle to navel, .....        | 2     | 3                        |
| Navel to pubis, .....           | 0     | $11\frac{1}{4}$          |
| Pubis to knee, .....            | 2     | 0                        |
| Length of arm, ... ..           | 1     | 7 humerus to elbow.      |
| Fore arm, .. ..                 | 1     | $8\frac{1}{4}$ to wrist. |
| Metatarsus and fingers, .....   | 1     | $2\frac{1}{4}$           |

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Total, .. 11  $6\frac{1}{4}$

Nose  $4\frac{1}{2}$  inches + 4 = 1 ft. 6 in. length of head.

1 ft. 6 in. + 8 = 12 ft.—length of figure.

But for the canopy and attendants one might consider this to be meant as a more perfect miniature of the great colossal figure, or as it is itself colossal, the Bawunguj, which we may call it par excellence. For this reason, and as other images will be met with precisely of the same kind, I have been particular in my description, lest there should be any misconception, and as we often gather more information from this source than even date affords, which are, I have little doubt, added generations or centuries after the erection of buildings, by some aspiring devotees.\* The temple or recess on which it stands, is open toward the great colossus, and built of cut stone, graduating to the top. This seems to me to have been merely meant as an enclosure to preserve the image from the debris of the hill, which might tumble on it either from the force of rain in the monsoon or other disturbing causes. There has been no attempt at any kind of covering or roof for it, and it is now in ruins. About six yards directly in front of this, has fallen or

\* Since I visited Bawunguj and wrote the above, I have had access to the marble Jain statue in the Society's Museum, Bombay, and it so closely resembles the erect one, that the description might almost be thought to have been borrowed from it; the only difference apparent is the clothing of the chief figure and the position of some of the attendants. There is no record of where this marble statue was brought from; most probably Abu, but wherever its habitat, it confirms the identity both of the object, and the religion which actuated the sculpture of both.

been carried, a sitting figure of Parswinath, 2 feet 9 inches high ; it is solitary and plain, the right hand and left leg uppermost.

In a more easterly direction are two other erect statues, half buried and evidently out of their proper places ; the most westerly has the solar radiance opened out behind it, divided into 29 points, and is only two feet above ground : the other has been much more elaborately carved ; the stone is lighter and brighter, and the proportion more graceful ; it has no canopy, but the curled hair tied in a knot on the crown of the head, the stone out of which it was worked is gracefully finished, and in a heart shape behind ; the two attendants are precisely similar to those on the first described image : 3 feet 5 inches of this figure are above ground. Further to the east is another built recess, 5 feet square, in which is a sitting figure of Parswinath, broken off unfortunately at the neck and 4 feet in height ; the fallen head has the peculiar curled hair and is over-shaded by the naga, the palm of the right hand has an ornament which I take to be the lotus, though I have never seen it with three leaves. On the plinth is another trefoil, but I almost think the lower leaf has been omitted or worn off, and that it must have been a *Srivatsa*. There is in Lord Valentia's collection, and in all Ceylon Bhudhistical image, a flower of this shape, but with a fourth leaf on the hand of the seated Budha, and curious enough the leaves have serrated edges also. These are the chief attractive objects in the neighbourhood of the great rock image. Higher up the hill is a small plateau, where are the remains of masonry, the bricks of apparently modern date, or else the inhabitants of the district have adhered to, or perhaps taken the custom from previous ages, for the bricks are of the same size and shape and material as those made at Burwanie in the present day, and peculiar in their proportions,—14 inches long, 9 broad and 3 thick. Here are two images, one full length and erect, but buried to the waist, and similar to those described ; the other is more ancient and set upon a pedestal as if intended for a niche. The figure is not large, scarcely 3 feet high, but differs from the others, being a female having very protruding breasts, and also in posture. It is represented as if seated on a bench, the left leg bent under the right knee. It has a canopy of 9 ribs, much resembling an umbrella, and its handle or stem runs down the left side. The face of the image is much injured, the hair visible and bound into a knot behind the right

ear. There is an abundance of ornaments on the arms and feet, and four rings on the neck, from the lowest of which two separate perpendicular pieces hang close to the breasts, underneath which they turn to the arm, which they encircle once. From the junction of the breast-pieces there depends the usual lotus within the lozenge. I imagined this to have been some ornamental chain, probably the Candora, which distinguishes the Seetambaree, and which is sometimes very long and entwined a good deal over the limbs, but from the general description, abundance of ornaments, protruding breast, and peculiar hair knot, I am inclined notwithstanding the posture, to regard it as a female deity, which we know were not uncommon with the Jainas, 48 being admitted into their Pantheon (see Bhudha Vilasa), and one among their Tirthankars. If I am correct she has a niche also in the small choultry upon the hill; the figures under her feet differ from those before described, and are rather remarkable. Under the right knee is a small one seated astride a tiger with the pillow under the left arm, and close to the foot an exceedingly small figure on its knee in a suppliant, almost in a weeping posture. The side is to the observer, and the head bent upon the left arm. Under the left knee the figure there placed also faces the last, but is seated, not cross-legged, the buttocks on the ground, the fore arms along the thighs, the elbows on the groins just as natives sit in the present day. Still ascending you enter near the summit of the hill a kind of rude gateway, with a small parapet wall on either side; upon a rising ground on the left are the walls of an old temple, which appears from the remains of the masonry to have been circular, with a vaulted dome; there remain in it yet two erect figures similar to that first described, of which there are several in the temple—now in use. Taking the path to the right and ascending some broken and irregular ground you reach the chief flight, which conducts to the temple; from the remains of stone, masses of bricks and mortar and figures jumbled together every where, the whole surface of the summit must have been built over. One erect figure is peculiar in standing isolated in an attitude not common in a divinity, but pertaining usually to Darpals,—that of listless attention, the hip being thrust out and the right hand leaning on it. Close to this commences the ascent of some 40 or 50 rude steps, which lead to a platform about 30 feet above the surrounding objects, but only upon one side, and evidently erected as a buttress or

abutment to the spur of the hill to the level of which only it is raised. The steps lead direct to the temple door, which faces the east, and must always have done so, there being no evidence whatever of any attempts at destruction. In Captain Stewart's remarks on Woon, great stress is laid on this direction of the doorway, as indicating itself of Brahmanical interference, the Jain temples there usually facing the north, and one, which is said to be Brahmanical, the east, but this is not an invariable rule, for Neelkunt Mahdeo's temple in the town faces the west, and at Hinnagund on the Krishna alluded to by Captain Wenbold, there is one which faces the east. Captain Stewart is borne out by Ram Raz in his illustrations of Hindoo architecture, and the custom in all Sivite temples in general, but the Mahawanso affirms that the *pulpits* in Bhudhistical Vehars always faced the east, the seats of the priests the north. In the Bawunguj the aspect of the temple and colossus coincide. In a temple where there is not much space to spare the chief object might naturally be placed fronting the entrance, as well for light as effect. In the Jain temples in Kanaree there are always 4 entrances. The Bawunguj temple is surrounded on three sides by a wall  $5\frac{1}{2}$  feet high, it is 82 feet long, measured inside, and 54 feet in front; at about  $\frac{2}{3}$  of its length, owing to the confined surface of the hill, the wall is contracted and closes in  $4\frac{1}{2}$  feet on each side, and in consequence is only 45 feet broad behind. Lengthways there are 16 recesses for figures of some Jain Iswarra, which from the wheel and lion being invariably depicted, I take to be those of Mahavira or Vaidhumana. 10 of these are in the narrow part of the wall, 16 in the broad, 11 in the rear. There are evidences of the wall having been continued some distance on either side in front adjoining the steps; it is however impossible to say decidedly how many figures there may have been recesses for, —whether any multiple of 24 or an indefinite number. In one of the temples at Abu I notice there are 56 mentioned, and at Indrapur near Belegula, there were 72 images (As. Res. Vol. IX.) but in 1807 only 42 were remaining in good condition, placed in a gallery under a portico supported by pillars, which was carried inside along the wall. In the temple I am describing there was no space for these images, which were consequently placed outside. The presence of the court wall would seem to make the building resemble that species of temple described by Dr. Buchanan as a Basti; which, though signifying a hill,



is applied to an open area surrounded by a wall, but Gomat Iswarra is the only image placed in it, generally colossal, the 24 Tirthankaras being worshipped in the Basti or covered temple, and represented as naked and sitting, exactly of the same form which will be found presently to be the case. This would give a composite character to the edifice embracing both descriptions. The temple itself, save in the admixture or variety of stone used, has the appearance of a modern structure externally, which the repairs and addition necessary to protect the figures inside have effected; its dome is completely so, but on entering that impression immediately ceases. It consists of an outer verandah in front, an inner square chamber, a vestibule, beyond and in rear of it the sanctuary for the chief object of worship, which here is the Prabathee, or impression of feet, 4 in number, two large and two small. The verandah is approached by 8 steps, and is 15 feet long by 9 feet wide; the pillars supporting it (with the exception of the four immediately in front, which are very old and of the amygdaloidal trap which forms the hills, surrounding wall, and even the figures in the recesses) are of yellow coral limestone, brought from Dedhallee, on the other side of the Nerbuddah.\* The roof of the verandah is flat, with the lotus inscribed within the lozenge itself within a square. On the north and east walls are niches containing an elephant upon which is some retinue of figures, 5 in number, the last, on each side near his tail, supported by an erect figure carved on the flanks or thighs of the elephant; they are all seated, the foremost holding a lotah. This seemed to me a complete anomaly in Bhudhistical or Jain sculptures. I have never seen them depicted except in a group or tableaux, while here they are represented more like Krishna's Gopia, save the matter of sex, and do not give the idea of being the Ganadharee or Ganadhipa, or followers of any of the Tirthankaras. The entrance from the verandah into the Mindra or principal chamber of the temple, is by two doors in the same wall, the outer much larger than the inner, being 8 feet high and 5-6 wide, while the latter was 5-4 high and 2-8 only in width. The posts and

\* Of the existence of this bed of yellow limestone I was not aware, and do not yet know its exact locale, but I took pains to hunt out the red variety of similar geological character, and of which the Mahomedan tombs and temples at Dhar and Mandee consist, it is found in situ at Neemkeera on the Maun Nuddee, in the heart of the Vindyan range below the Hydree ghaut.

supports of both doors, as well as the flanking pillars of the outer, being modern and of coral limestone. A descent of two steps leads into the chamber, which is 16 ft. 3 in. square. Exactly a foot on each side of the doorway the pilasters commence; the intercolumniation being tetrastyle and the pillars four feet apart. The pilasters are nearly all dissimilar, and resemble the first pillars visible; the centre ones are different and more modern, all 6 ft. 8 in. high, supporting slabs across the ceiling, above which is cut the lotus within the lozenge and square, a form found likewise on the roof of the verandah and sanctuary itself. There are two plain sitting figures on each side of the doorway, as you enter, and in the centre of the side walls 20 others 5 feet high, and raised 3 feet from the ground on a Sinhasa; that on the left wall is Parswinath; he has Seshnaga or Dhare Nadaru for a canopy, with the lotus engraved on his breast. The opposite figure on the right wall has no covering, but the hair merely; adjoining there are four others also seated, but smaller. On the wall facing the entrance, and between each pilaster, are figures of quite an opposite character, viz. erect; the principal one is on the left; it is almost precisely the same as that met with on the hill below, but lighter and more fitted for a room; the head canopy is most richly carved and has festooned supports at the sides; the elephants have lotahs on their trunks. If there is any difference it is in having outside the wreath-bearers one row of figures, the upper with stalks of the lotus over the shoulder, and the lower resting with their hands on maces or staffs. The forefingers of the chief image are not extended on the thigh, but bent over the middle ones. There are altogether 20 images in this temple, 3 large and 17 small. On the north side of one of the figures of Parswinath there are 4 short lines scratched but very much worn and too indistinct to copy; opposite the outer entrance is that to the inner chamber, which has a most elaborately carved doorway and six receding pillars with square and projecting capitals cut in the depth of the wall. A descent of two steps leads into a little vestibule 6 ft. 3 in. square, in which are erect figures, also similar to the previous ones. From this vestibule is the entrance to the sanctuary, which is quite plain; a small altar is raised in front of the door about 2 feet high and on it are carved in relief two feet, very large flanked by two others somewhat larger; there is no other ornament of any kind, but a little miniature on the pedestal with round ear-rings; about the feet were grains

of rice and flowers, giving proof of the recent presence of devotees. The same objects, viz. representations of feet, were found not as chief objects, but at the foot of a statue in another very small building on the extreme edge of the same hill to the west, very similar to those seen in Colonel Todd's plate of the temple of Kamalmair. In the centre of the enclosing wall of the large temple is an opening leading along the spur of the hill to this building, 20 paces distant; it has a cupola made of brick and coarse plaster, very uneven; it is only 7 feet high and 5 square, with an entrance of 2 ft. 10 in. through which it is of course necessary to creep inside, and too low to admit of standing straight when there, probably meant to cause the necessary degree of prostration to the deity. Facing the door and by itself was a tolerable sized Jain image in an attitude not found elsewhere among the figures either above or below or in the temple, viz. that of supplication; the palms of the hands joined together, the extremities of the fingers pointed upwards and the thumbs on the breasts. As a curious coincidence I may mention that there is a very old figure of exactly this character and posture half buried in the land in the neighbourhood of the Jain temples at Woon. There were two attendant figures below this, the outer hip thrust out, upon which the outer hand rests, the inner leg bent and the corresponding arm supporting a substance more like a lengthened bell; *sic-in-origine*, my memory does not serve me as to the exact nature of this emblem, but from its having been held over the head of a figure in another place it must be a rude umbrella, though as well as I recollect it was precisely similar to those surrounding the Gaya, Buddhistical figures at plate 70, figures 6, 7, 8, of Moore's Pantheon. On the right wall is the same figure cut in marble with a lotus carved on the breast, it is apparently of recent workmanship. The group is rather remarkable, for underneath are two figures, right and left, the former holding the oblong-shaped symbol over the head of a lower figure, which is kneeling or seated upon one leg bent underneath, the hands in front in the act of supplication, and a *chord with tassel leading from the wrists to a jug or jar* which is placed near its right foot. The left figure is on both knees and two jugs are near it of a double form.

On the pedestal are the following letters:—

वर्द्धमान राक्षस, १६५६ Wardhamán Rákshasa, 1659.

On the left wall are two large figures, one holding a lotus over the

shoulder, but subordinate to no other that I could perceive, this was decidedly Svetámbara, and the *only one*, the cloth hanging down to the knee and covering the belly and hips. On the pedestal were a pair of feet, the soles turned up and the toes turned outwards; next to this were two figures resembling the solitary one on the ascent of the hill, apparently very old; they were seated as if on a bench, one leg bent under the other, which was defending a child on the left knee, with its right hand to the left breast, both of which were unusually large; the mace in one hand of the figure and some fruits in the other; a lion under the right knee.—This seems a further confirmation of the solitary little figure on the hill being female, and had it four arms, would be Bhavānī and a recognition of a deity of the Hindoo Pantheon that one would not expect in conjunction with such unequivocal Jain figures. As nature personified, she is admitted by the Jainas as a Devi, and gives a name to a class, Bhawānīpatis; one or two are worshipped daily by them, and her place by the side of a Tirthankara is in correct keeping, but this figure has not a multiplicity of arms, and as we have a Jain Tirthankara, “Sumati,” and according to the Svetámbara, a second Malli-nāth, there is no occasion to stretch a point or trespass upon the Hindoo mythological system. There was nothing further of importance in this little building, so I retraced my steps to examine the figures in the recesses of the enclosing wall. Of 43 niches there were 3 empty, 4 figures only were erect, the rest seated cross-legged, and but one with the snake canopy of Parsvanath; they were all very ancient, evidently of the same rock of which the temple and hill were formed, an amygdaloidal trap with decomposing nodules, which left a white, red, or green appearance or incrustation upon them as they happened to be constituted; the recesses were constructed by one slab forming the roof or upper part, on the either side, and rough uncemented stones the sides. The group was ranged usually in the following manner on a slab. I must premise that both sides being alike, the description applies to the whole group. Directly in the centre is the chief figure seated with the hands crossed over his feet, the right uppermost, over his head a canopy, with two or three retiring ledges or circles, upon the uppermost of which was also a figure sometimes seated, at others kneeling, either on one knee or two, and supported by a round pillow, which was either plain or tied in the middle; some little distance apart at each corner of

the slab, parallel with the head, was a small figure always seated, and occasionally in a portico by itself. Between it and the canopy, with their hind feet upon the head of this seated figure, was an elephant, the trunk down, frequently with Bodhisatvas on its back, or between it and the canopy two small figures with their knees bent under, as if clinging to the canopy. Under the four feet of the elephant, close to it, still parallel with the head of the chief figure, two small flying figures bearing wreaths in both hands, the nearer clothed, the outer a woman with fruit in her hand. Directly under these, along the arm of the chief images, a full length figure, its nearest hand supporting the feet of the flying figure above, or with lotus stalks carried over the shoulder, and the outer hand with *karrá*, &c. On the corresponding hip or thigh, these are always clothed and have the spiral caps of attendants. Outside of these, and of the same height, is another erect figure, the near hands in respect to the large image resting upon a fish, bird or club, the other by the side. At the feet of both of these below, but outside the knees, there are two small figures, one seated cross-legged, the other as if on a bench with one leg dangling, the right hand holding a staff; these seldom vary. Outside of them again under the small figure seated in the corner above, is a pillar supported by pigmies (*sujalya*) having for its shaft a tiger rampant, on a reclining elephant as its base. Immediately under the knees and feet of the chief image are four diminutive pillars, between the outer of which is a lion facing the wheel, which is in the centre. This latter is but the personification of the earth, or two cups meeting at the base, according to the Jain belief: the flat surface at the junction, the earth—it presents no form of the praying wheel pictured by Colonel Sykes in his notes on the moral and political state of India, and is represented with its tire in front, not its broad axis.

In those which seem very old and weather-beaten there is a second figure over the first in a little porch supported by birds, with wings endorsed on each side; on a level with its knees two others similar to it, under which are the elephants. Where the principal figure is erect the niche is carved a good deal, and there is a pillar on each side, the tops of the figures of one hand touching a club or bird's head.

From the above rough notes it may fairly be deduced I think that the

colossal image, as well as all the other figures, are Jaina. I cannot trace one single symbol of Brahmanical intrusion, and in this there is a striking singularity; in every other situation and country it has struck me to be so universal as to amount almost to a law or principal that wherever edifices, temples or caves of any religious persuasion abounded, that was selected by the holders of a rival and succeeding creed as the spot to establish themselves, and to vie with their predecessors in magnificence and extent of structure. Such is not the case however either with the colossus or temple of Bāwangaj, nor, with the trifling exception of a single insignificant image of Ganesa, is it so at the caves of Bang. This may possibly argue no very great antiquity for them, but it enables us in this age to see them unmixed and in their purity, seathed only by the ruthless hand of time. It is not the least remarkable part of the colossal figure at Bāwangaj, that it is the only one of the kind as yet known in India. There are statues at Kanara, at Belegula, 70 feet 3 inches high; at Einur, 35, and Karkal 36-6. The largest of these is variously computed 18 times a man's height, (18 fathoms and) 6 times its own feet, which is 9 feet, e. i. 54. This is so exactly the half of 18 fathoms, or 108 feet, that there must have been some error in reckoning the fathom, however the true height, according to Dr. Buchanan, is little more than 70 feet. The Bāwangaj must be at least 90, it being 73-8 to the calf of the leg alone. The height, nudity and posture of the Kanara figures and their dedication to Gomat Iswara, or Indra Bhuta, the disciple of Maha, proved now almost beyond question to be identical with Buddha himself, indicate resemblance to the Bāwangaj figure, and the differences perhaps consist in respects which may be considered merely local, for instance, the hair is arched, not cut straight across the forehead; the earrings do not touch the shoulders, and on the arms and legs are traced branches of a tree with leaves which arise from a series of mounds behind, and between the legs, one for each arm and leg. In India the figures that approach nearest to Bāwangaj in point of construction are those in the hill fort of Gwalior, of which there are very meagre descriptions. Mr. Fergusson says of rock cut temples, that "the colossal figures, some sitting, some standing, some 30 or 40 feet high, have sometimes a screen before them which form a small chamber," and Colonel Sleeman thus depicts them in his *Rambles of an Indian Official*: "On the face of the rock between the glacis and foot

of the wall are cut out in bold relief the colossal figures of men sitting bare-headed under canopies on each side of a throne or temple, and in another place the colossal figure of a man standing naked and facing outward, which I took to be that of Buddha." Of the colossal figure of Mata Koonar in the district of Gorakpore, Mr. Prinsep has not thought necessary to give the height or a sketch. His opinion of its being a figure of Buddha is sufficient to authorize its reception as such, but the omission is unfortunate for comparison sake. He states, it is surrounded with smaller compartments, descriptive of various acts of Buddha's life, surmounted also above by angels and gods, and below supported by the Sinha and elephant, and is probably connected with the Mathia Lat, described by Mr. Hodgson, Asiatic Society's Journal, Vol. 3. Mathia being evidently the patronymic of Mata and Koonar or Kunwar, a corruption of Kumára, the youthful, or god of war. Mr. Liston's description however shews several points in which it is dissimilar to the Báwangaj rock image, which is either essentially Jaina or of the esoteric Buddha creed. Mata Koonar is associated with devatas and attendant figures on each side, with flames around their heads, and their hands on goats, and the lotus over the shoulder, whereas every thing about the Báwangaj is particularly plain. The only other hill figures an account of which has been published, are the 3 Bhuts at Bamiyan, the largest of which is 120 feet high; these, though traditionally said to have been inhabited by Abraham, and to have been excavated before the flood (Colonel Wilford, Asiatic Researches, 6, Vol.) are considered by every traveller to be Buddhistical. Mr. Masson, the latest visitor, says, they are in the same attitude as the figure at Kanari, that of preaching, and the paintings are similar all over the caves. Sir A. Burnes is the only author who makes allusion to their Jain extraction, and thinks the paintings over the idol to have a close resemblance to the images of the Jain temples in western India, as Mount Abu at Girnar, and Palitana in Kattywar, and can trace no resemblance to the figures in the caves of Salsette. Notwithstanding such high authority, they can scarcely be said to belong to the Jain faith, as we know it. Their figures are never in such a posture, and the clothing is thrown loosely over, exposing the right shoulder; the Bamiyan figures besides were in existence at a time when the Jain religion was certainly not in the ascendant, while Buddhism as certainly was.

Mr. Prinsep states, that it was in the height of its glory a century or two prior to the Christian era, from Kashmere to Ceylon, and M. Remusat, from the examination of Fa Hian's travels, that so late as the beginning of the 5th century Buddhism was flourishing in the same regions. These therefore have little in accordance with the Bāwangaj image. I have of course excluded from the catalogue of rock images, that at De-wass, described by Lieut. Conolly (Prinsep's Journal, Vol. 6, page 855), as gigantic, because it is so completely Brahmanical, being a form of the Sacti of Siva, under the name of Chāmundá. One of the principal matters of interest however connected with both the rock image and temple, is the date that can be assigned them, if we can depend upon those we meet with on buildings, which I am almost persuaded are in many instances the handiwork of regenerators, not founders. Information on this head resolves itself into the evidence afforded by the temple and figure separately as well as conjointly, and it is important to prove the connection of both if possible, for though the worship of the Prabatha, Paduká, or representation of feet, and the numerous emblems of the lion in the recesses, and the inscription at the foot of one of the most modern figures may perhaps, in conjunction with the nakedness of all to induce us, attribute them to Vardhamána Mahāvira. The manifestly abandoned state of the colossal rock image and the figures in front of it might lead us justly to the inference that it had ceased to be an object of worship, which if they were one and the same divinity, would not be probable, and I cannot but admit that the nakedness of the figure making it Digambara, the admitted antiquity of this sect, their great prevalence in Rajpootana, (though the Swetámbara, according to Lieut. Conolly, are more numerous in Malwa, Op. Cit.) and their devotion to Rishabha, the 1st Tirthankara, and acknowledged chief saint, his extreme height 500 poles, or Dhamish (albeit imaginary) the fact of his primitive shrine being at Abu, and a temple and large figure being dedicated to him at the top of a high mountain, Satrunjaya near Pálithána\* in

\* Palithana, near Bownagar in Kattywar, is as celebrated a place of pilgrimage for the Jains in the western side of India as Samat Sikhara in Behar and Belegula in Canara; there are a great number of temples on the hill, and a treasury so large as to be placed under the management of four large bankers, two of whom are inhabitants of and reside in Ahmedabad, one in Bombay, one in Jeysulmeer. The Calpa Sutra, page 10, says, "there is no holy place superior to Sri-Satrunjaya."



Kattywar, under the appellation of Adhiswara Rishabhadeva, called by the Srawaka or laity, Adi Bhudha, and to which there is a large annual Tirtha, and the circumstances of the exact spot in which his apotheosis took place being undecided, being the mountain of Catachachal, according to Major Delamaine, and Ashtapáda according to Mr. Colebrooke, are circumstances not to be rejected in attributing the colossus to him. Yet if it were his, the brahmins who admit him into their mythology as 2nd in a list of kings in their regal families (Bhagavat Purána, and Dr. Stevenson in Kalpa Sutra) would be likely to have some more certain records of him, and he would have the chief, not secondary place in the temple, unless in the recent changes it has undergone, the substitution of Mahávira as a later and better known divinity may have been made, and the Bawangaj and other divinities have been forsaken and deserted on account of some imaginary superstition or ill fortune, which Dr. Stevenson assures me, is among the Jains not an unfrequent occurrence. To whosoever honor the colossus may have been originally cut—whether Rishabha or Vardhamána,—and one of the two it must have been,—the worship of both it and the small statues near him, including one or two of Parsvanath even has passed away. The inclusion of the latter in this desertion, shewing the correctness of Dr. Stevenson's surmise, for notwithstanding this, the temple on the hill gives a place to them and to more than one of the 23 Tirthankaras besides, while all those on the hill below are perfectly neglected. There are however many difficulties to overcome and reconcile, which are not a little puzzling. Rock images, in a general sense, we may naturally suppose to have been cut in rude, if not ancient times, and in truth every thing carved on rocks bears on this fact also the stamp of antiquity, and is associated with such in our minds. Whether images, temples or inscriptions, they leave with us an impression that the projectors of such were in a degree in ignorance of the state of art, if any such existed, before their time, and that their conceptions were rude and imperfect, and this has particular reference to sculpture and statues. We can scarcely conceive it possible that the individuals composing, for instance, such a large and numerous sect as the Jains, spread over such an immense tract of country, could in the 11th century have been so totally unaware of the science of sculpture as to cut such ill-shapen and disproportioned images in the face of a hill, with examples of the beautiful works of

previous centuries within 40 miles of the caves of Bang, and leave it exposed to the destructive force of the elements. Preservation scarcely one would imagine could have been had in view in such a course, yet experience has proved that rocks and nature are more commemorative agents than all the art of man. The Bamiyan figures have withstood the play of artillery; the cave temples, the sacriligious chisel of the sculptor, and notwithstanding the injuries so caused we can trace through them some evidences of the originators of these antiquarian monuments; not so with the later and more approved custom of enshrining within temples, desertion of these latter being almost equivalent and synonymous with destruction. In the Bawangaj figures we have evidence of a succession of science; all improvements upon the great figure, the more finished execution being, we must naturally infer, the most modern and the reserve the evidence of antiquity. In chronology we often, as in this instance, can discover no era or date to guide us, and when we do, are disposed to regard it as a source of error at all times magnified and perverted by the stroke of a pen; we therefore seek to derive from the observation of the natural characters of sculptures and figures the intentions, tenets, and opinions of the framers, a method of reasoning applicable to times and edifices within our own eras, and in a great measure decisive and indicative of national character. This is especially applicable to the varied sculptures found at Bawangaj, the great rock image being the most rough and artless, while the smaller but still colossal figures placed opposite to it,—images it may be of the same divinity,—are most perfect and polished in comparison. I do not mean to infer that the antiquity assumed from this source is sufficient to warrant one going back to the Dwapar Yug, and fixing upon Rishabha\* as the deity personified on account of his antiquity, (for there is ample time for Mahāvira to come in, his apotheosis being 569 B. C.) but there are strong grounds for the former suggestion, as well in this as in the fact of the images being erect as well as sitting. Parsvanath, and

\* Rishabha.—If any credit is to be attached to the date of Rishabha's apotheosis which took place 3 years  $8\frac{1}{4}$  months before the end of the 3rd age, and we admit the Jain method of commencing the Kali Yug or 4th age, as 1078 B. C. we should have a positive date to Rishabha of 1074 B. C.—comparatively a recent one. The Brahmin date of the Kali Yug is however much better fixed and established, and by it his date would be 3098 B. C.

whatever other Tirthankara is represented, being without a fringe to the canopy, denoting an inferiority and apparent subordination to the great figure, which, as Mahāvira succeeded Parswinath, would not be likely. I am free to confess however that the subordinate nature of these is but a conjecture of my own, but I may safely class with the same date and period, the temple itself and the figures in the recess, though not those inside either the temple or choultry.\* Of the date of the temple I shall have occasion to speak presently. The seated figures on the tablets in the recess of the court wall, accompanied by the almost invariable emblem of the lion, would point to Mahāvira, the only Digambara-Tirthankara known, and several reasons of weight conduce to his coincidence with the rock image ;—1st, the precision of his era, which unlike Rishabha is not disputable,—the likelihood of Rishabha's being little more than the first ascetic, not the extensive promulgation of the faith ; the inscription on the small temple Vardhamāna Rakshasa, the worship of the Prapatha or Paduka,—almost exclusively his own, both in the large temple and at the foot of a statue identical with the small figures opposite the colossus. If heights can be trusted, and are not as frivolous and exaggerated as dates, and we proceed in the ratio of decrease, which the Tirthankaras are made to do, viz. from Rishabha to Sitala, by 50 poles, Sitala to Ananta by 10, and Ananta to Nemi, the

\* The only support to my supposition regarding the inferiority of the small figures is the very slight one of the name by which two of them are at present known—"Oodura" and "Doodura" and here again the common appellation of figures may tend to establish a clue from which more positive data may yet be arrived at. After hunting over many lists for those names I fell in with one in Vol. IX. A. Rec. received from Charucirti Acharya, the Jain chief pontiff at Belegula. It would appear that according to the Jain belief there were born other 24 Tirthankaras in the world during the first age, beside the 24 after Rishabha. Among the names of these Tirthankaras of the Antacāla or past times, stand Odara, the 8th, and in a note of Mr. Colebrooke's, a corresponding list is given by Hemachandra Acharya, the author of the Abhidhāna Chintāmini in which the 8th is called Damodara, a name to this day used frequently as a first name by the Sarawaks, though claimed as usual and applied by Brahmins to Vishnu. Unfortunately this coincidence of name has not as yet led to any date, but there doubtless is one credible and substantial and much less apocryphal than the Tretā Yuga, and connected with some Sādhu or Guru, for the Jains pay a respectful adoration to those who obtained Moksha in times of antiquity, even more assiduously and with greater veneration than to the Tirthankaras who were incarnate in the Utsarpini period.

21st and last whose absolute height is given by Mr. Colebrooke, viz. 5 poles, we may suppose Mahāvira to be within bounds, and have another ground for ascribing the rock image to him. We know that Mahāvira's apotheosis took place at Pawapuri, in Behar, but the Jains worship as well the places where their Iswarahs were begotten and born, where they resigned worldly pleasures and began to meditate, as well as where they obtained Nirvana, though I am not aware that any of them took place in the district of Burwanie. A closer study of the figures and emblems, and digging round the pedestals and feet of the statues where the chief events of the Deva's life are usually represented, will, I dare say, elicit more accurate information, and an enquiry made into the records of the town of Burwanie, and conversation with the Jain devotees at the period of their tirtha, would doubtless assist materially and lead to much more certain dates than a cursory visit of a few hours. I am however much afraid that we shall light upon no very remote date, either for the figure or the temple, for although on the authority of the Yappa Jaina Patavali (Trans. A. S. Great Britain and Ireland, Vol. 3), written by Calca Acharya, A. D. 415, Jain temples were first built in the year 882, after Virat, i. e. A. D. 313, during the spiritual government of Mandeva Surie, I have not yet (with the exception of the temple of Kurswa near Katah, whose date is given by Colonel Todd unmistakably S. 597) seen an inscription of earlier date than the 12th Century. The Abu temples, reckoned the most ancient, have then 1,100 and 1,400, and almost all those in Behar, at Nakkaun, Pari and Calurpur near Champanagar, have them respectively somewhat 1676, 1605, 1694; and the temples of Woom in Nimara, date 1192, 1203, and 1243, 1263. In Rajpootana they are about the same age—Nadole some with 1208, Jabrapatan 1103, Kuraira 1400, Cheetore 1449. We thus bring the most flourishing era of Jainism in respect to architecture, to the 11 and 12 centuries, and this tallies precisely with Professor Wilson's opinion; he says the Jain faith was introduced in the Peninsula 7th century, A. D., its course south was stopped at an earlier period, but it extended itself to the west and centre of India, and enjoyed some consideration in the 10 and 11 centuries." We must of course take this as its resuscitation or revival after the obscurity into which it was thrown by its rival creed, Buddhism, and which lasted nearly 1,000 years. Professor

Wilson conceives however, and is there met by the Behar inscriptions, that it received its final overthrow in the 12th century. The date of those I have given above would certainly indicate that the religion every where had survived the persecution in the 9th century of Sankara Acharya and Kumarilla Batta, and I hope to shew presently that the Jain temples at Woon, not 80 miles distant from Bawangaj, were, if not built, at least repaired, and a colossal figure set up in the reign of Yasovarmá Deva, sovereign of Dhar in 1192, fourth in descent from the 3d Raja Bhoja. Mr. Ferguson thinks the Gwalior figures to be of the 11 or 12 century,—an assumption which would imply a degeneration in the arts gradatim, or in ignorance of those of previous ages, which is contrary to the experience of all nations. It is scarcely probable for such a descent to have occurred from the beautiful and finished sculpture of the caves of previous centuries, both before and after the year of our Lord, to such rudeness and disproportion. Major Delamaine asserts that none of the temples at Mandu are earlier than the 12th century. There were several inscriptions in the Balbood character in the Bawangaj temple on each side, but I had not time to copy them, subsequently however I obtained the services of a pundit to do so, and he sent me four, one from each side, leaving one very old uncopied, it being too much worn to be taken off. Perhaps from this very one we may yet learn more than all the others put together.

The inscriptions he has sent consist of four or five, and from the Sanskrita form of the letters and modes of expression, do not appear very ancient: there is a possibility of his having departed from the real character of the letters and transcribed them in modern Balbood, the language best known to himself, but I think that this is not the case, from his having gone out of his way to explain in Sanskrita the meaning he conceived to pertain to them, his version being very wide of the mark; for this reason I consider them facsimilar and not without their interest. They are inscribed one upon each wall of the temple, and one over the door, and bear distinct dates, with an interval of 293 years—nearly 3 centuries—and it is remarkable that the name of the temple should be preserved or adhered to for so long a time, considering the peculiar ideas of the Jains regarding names. The inscriptions which are on the eastern and southern walls, bear date Sumbut 1223, of

Virkrama, I presume, as we are in Malwa, corresponding to A. D. 1166, and are both eulogiums upon Rámachandra, said to be the founder of the temple. The phraseology of the eastern one is particularly poetical and beautiful; language more chaste and emblematical could scarcely be selected, or associations more pure than that applied to Rámachandra's fame, which is described as white as the moon, the kunda flower and snow. The southern inscription specifies Rámachandra as the builder of the temple, and departs from the name of Indrajit, given to it in the preceding one, changing it to Surapatijit, a cognomen of the same deity. It also gives an outline of his connections, making him of the family of Devanandamuni, and pupil of Lokanandamuni, and adored by *Vana Raja*, the Lord of the earth. Here is a distinct name of a sovereign and, it would have been very satisfactory to have discovered a reigning prince in him, but there is none to whom the name applies. The nearest approximation in sound is *Vana Raja*, of the Anhilwarra Dynasty, but his era was 417 years before, at which time it is just possible the first temple was built during his reign, Samvat 802. Who the reigning prince of Avanti in Samvat 1223 may have been, is not quite clear, but I think it can be fixed. From an inscription of Colonel Todd's, given in the Transactions of the As. Soc. Gr. Britain and Ireland, of a Copper plate grant found at Ujjayina, the ages of several kings are satisfactorily determined, and it would seem that in Samvat 1200, only 23 years prior to the Indrajit temple inscription, and Lachsman Varma, the 4th in descent from the 3d Raja Bhoja, was the reigning prince at Dhar, the then capital of Avanti, subordinate to Jaya Singh of Pátan, who had conquered his grandfather, Nara Varma, and reigned in chief from Samvat 1150 to Sumbat 1201. The successor of Jaya Singh, in Mr. Prinsep's list, is made his son Ajayapala, without date, and on the same authority in the Malwa line, Birsal is placed next to Lachsman Varma, but Colonel Todd's inscription gives a successor to Lachsman, viz. his brother Jaya Varma. Unfortunately this part of the plate was corroded, and the date could not be made out, but it is not too much to assume that as Lachsman reigned in Samvat 1200, and was above them, either he or his brother and successor, Jaya Varma, was in power in 1223.\*

\* Colonel Sykes, in his notes on the moral, religious and political state of India.

For a century or two about this time both, in Malwa and Rajpootana, the Jain creed appears to have been in its zenith. The temples at Woon, about 50 miles distant from Báwangaj, bear date 1203, 1243, 1263. It would seem almost as if the Báwangaj temple filled up the blank of 20 years which the Jain temples bear relatively to one another, and which they may have occupied in building or completion, the workman and every available assistance being given to effect it. Thus Woon 1203, Báwangaj 1223, and Woon 1243, ditto 1263. A prior date of 1192 on a figure at Woon is the very year of Col. Todd's plate, which has Lachman Varma's sign manual, and in 1218 according to another plate of Col. Todd's, Aldan Dera Achohun prince built at Hadole a temple to Mahāvira. Of his persuasion there is no doubt, scarcely of Jaya Varma's. According to the Camarapala Charitra, his ancestor Boja was a proselyte to the Jain faith, and his father, Yasovarman's grant is thus worded: "The great prince acquaints the people, Pattalica brahmans and others," making the brahmans a sect separate and distinct from the people, added to which Jaya Singh of Pattun, from whom Yasovarman held in feoff, was of the Anhulwarra dynasty, remarkable for their adherence to Jainism, and himself in particular. It is not without some reason then we surmise that the temple of Indrajit, if really built in 1223 by Rámachandra, was designed and constructed at a time when the Jain religion was flourishing in the territories pertaining to Avanti. From the honesty with which the repairs of the temple is recorded in the next inscription, Samvat 1516, we may at least assume its having been erected, by Rámachandra, until we can discover prior data.

From the specification of its being the large temple which was repaired, it is to be inferred that there were others at hand which, as I have previously noted was the case, the summit of the hill being strewed with figures in its bricks and mortar, and the frustum of one distinct temple. The sovereign named in the inscription over the doorway is gives an inscription for Piplianagar and Bhopal on Copper plates, from which the succession appears as follows :—

- |                            |                        |
|----------------------------|------------------------|
| 1. Raja Bhoja Deva,        | 6. Vendhayavarman,     |
| 2. Son, Udayaditya,        | 7. Son, Amushyavarman, |
| 3. Naravarman,             | 8. Subhatavarman,      |
| 4. Yasovarman, A. D. 1137, | 9. Son, Arjun.         |
| 5. Jayavarman, A. D. 1143, |                        |

In this list Lachman Varma is left out, but the date of Jaya Varman's reign corresponds exactly with Colonel Todd's plates.

called *Mahummoond* Rajah, of the Soorsein family. At that period Malwa was subject to Mahomedan power entirely, and likewise Gujerat and the greater part of Rajasthan, the ruler of Malwa in sumbut 1516 being the celebrated Mahmood Ghiljee, the 1st. It is curious to find him styled Raja and his family and race brought into a record of a temple of a Hindu deity. Surasena is doubtless meant for Suryasena, of the race of the sun, but it is a brahman term. However it speaks volumes for Mahmood's toleration and character.—Ferishta, who is an author of equal credit and celebrity, states that both Hindu and Mahomedans were alike happy under Mahmood's sway, it being his policy to unite them in ties of concord and amity, and they consequently in his reign enjoyed prosperity and repose in an unusual degree. To no other prince can a reign be assigned at this period, and it was in the 16th year of his reign that the temple was repaired. Mahmood succeeded to the throne of Hindoo in Samvat 1500, and reigned for 34 years. Under his government Malwa reached its highest prosperity as a kingdom; its territories were bounded by the Satpooras on the East and Bundlekand on the West. We are thus enabled to refer both inscriptions to reigning sovereigns comparatively modern it is true, but we may yet discover others who will assist to fill up the many blanks that historical catalogues require. In the later inscriptions of Samvat 1516, the Ratnakirti take pains to describe his spiritual predecessors and teachers, Jain gurus and arhats doubtless, of some local consideration. He makes himself the 3rd descendant, the pupil of Shri Kamalkirti Deva, who was the grandfather of Rayavudie, and pupil of Shri Hemakirti, and he again of Shri Kshemakirti. The matter worthy of note in these is the term kirti, a very usual title of Digambara Jats, which I have in another place supposed the Indrajit Jains to be. After them follow a list of local gurus who assisted in consecrating and in the daily worship of the image of Indrajit. The paleography of the appellation, the affix of the word Jain to it, and its application to a figure, is singular, equally is its having been preserved unchangeable contrary to the habit of the Jains, who are whimsical in these matters. Were Indra the deity invoked it would not be surprising, but there is no trace whatever of an image of him; none certainly in a posture of adoration, or as Dvarapals, the position and place assigned to the devatas, brahman and other wise men which the Jains acknowledge. That they recognise deities of the



brahmans is notorious, but they are subordinate not principal ones, even Brahma and Maheswara are at present deities but inferior in rank and power to Indra, who is considered "the chief of all the happy beings that reside in Swarga;" by the Jains termed Sukko or Sakkee (mighty) and worshipped by prayer and offerings of fruits and flowers, and he is a favorite presiding deity, but not solitary, there being 64 Indras, two of whom govern one of their classes, the Bhawanipratis. Indra is also worshipped in his character as the regent of a quarter, and the Rahtores of Canouj are said to have sprung from the back-bone of one (Col. Sykes). We might thus easily be prepared for the name of Indra, and attach a modern source to it, but here we have the name not of Indra, but of the figurative conqueror of Indra, Indrajit, the son of Ravana, the Meghanada, so renowned in the wars of Rama, preserved for three centuries in the records of the temple, and applied not only to the temples, but also to a figure, the object of worship, and how one of the Tirthankaras would have got the surname of Indrajit it is difficult to say, unless as in Meghanada's case, the term is used metaphorically as an attribute of great power, which I take to be the true rational of the term for Ravana, king of the Rakshasas, is said to have worshipped the image of Gomat Iswara at Beligula, but at Bawangaj his son Indrajit is made a devata and himself worshipped, a manifest contradiction, and we find a temple at Woon bearing the very same name. En passant, I may remark the very strong affinity between the Jain structures at Bawangaj and Woon, a similarity extending to the date, name and isolated figures, which will form the subject of another paper. The orthography of the word *उद्धरति* scarcely permits a resolution into its component parts, which but for its established meaning and historical reference might be attempted. For instance, Indra and Ajit referring to the 3rd Tirthankara, and written without the medial, but against any such corruption is the distinct affix *जान* *jāt* to *सक्र* *Sakra*, and *सुरपति* *Surapati*, names of Indra decisive, I think that Indra and not Ajit is the deity meant, otherwise Indra's names would be separate and other appellation Ajetha given. The most important inscription which I myself met with at Bawangaj was a small one upon the Nokar foot of an image of Parswinath, found near the large figure, and which I brought away with me, and have appended to the others. For some time I was baffled by it, but the Rev. Dr. Wilson, to whom I feel under great

obligation for much valuable instruction and assistance, and the decipherment and translation of this, at once recognised the Pali form of many of the letters and expressions, which is an important fact, as it implies, from the more ancient form of the language, a more remote and older date for the images than that in which the temple inscriptions are. Kantharanatha is either a name of Párswanath, meant for Kuntē, Chaturrahati is the Pali form of the Sanskrit Chatur Vinshati (24). Saka Sala, of the Sanskrit Shaka Shala, and Panati of Pranati. The second letter of the group is a very difficult one. Dr. Wilson found it to correspond with an inscription in his private collection from Abu, as also the form of the ॠ, which the Jains write with a terminating stroke to the left like ru.

The most interesting letter is perhaps the ॡ hu, in the second line, which is conformable with the Gujerat character of the 2nd century.

The stone is a close-grained dark limestone, whether found in situ near the Nerbudda I cannot say, but probably not far from Barwáni. It seems the same formation in which Dr. Leith has discovered fossils in, and which is to be seen in the island of Bombay, on the other side of the causeway, at the breach, but less slaty. The meeting with it 350 miles inland on the other side of probably the same basaltic overflow with which it is connected here, is a coincidence which may prove of geological as well as historical moment. The temple itself requires short notice. In structure it is so decidedly modern from the repairs it has undergone, that little can be elicited regarding its original form; at present it can scarcely come under any denomination of temple, but that of misra, mixed, a term having reference to the materials with which it is built.

The oldest Jain temples in India, as Behar, Abu and Girnar, have a large dome in the centre, and occasionally smaller ones in the corners, some have pyramidal spires, as in Nimar Guyt, and Siam, where the building over the Prabhat is especially described as pyramidal; but there is only one flat one that I am aware of—the temple to Parswinath, half way down the mountain of Samet Sikhar. The circular frustrum still remaining at the Báwangaj temple, over which the modern dome has been placed, might lead to the supposition that the sanctuary and vestibule were included in a vaulted roof, as with the temple of Kamalmair in Rajpootana. The Garbha Gribá or chief body of the temple is flat

and does not look as if it had been disturbed, and may have been flat originally. In other respects the temple was the usual vestibule and mindra, but no semblance of a colonade or porch. The pillars nearly all differ; they are small, six feet eight inches only in height, light and tapering and devoid of much ornament, but this, with their projections on the shaft and bracket-shaped capitals, only attest their antiquity.

It is remarkable though not rare that the Paduká or feet-worship which extends over such an immense tract of country,—Ceylon, Malwa, Siam, Ava, and Behar, should be discovered on a solitary mountain in the centre of India, and speaks much for the uniformity of the religion, whether in its primitive form of Buddhism or that of the succeeding faith of the Jains, but it is, I fancy, less reverently adored than among the Siamese, where the Paduká are covered with water for the devotees to sprinkle and wash away the stain of sin,—a potency not admitted by the Jains in central India.

Those at Báwangaj are probably emblematical of Mahávira, to whom such are generally attributed,—the only exception which I know being some to Vasupujya, in a temple at Carbirpur near Chámpánagar in Behar, and to Parsvanath at Samet Sikhar. There is an annual Tirtha to Báwangaj, most likely the feast of the Pajusan or Paryushana, but of the season of it I have no note, nor whether it is kept in conformity with that festival in respect to religious meditation, fasting and reading. I believe the assemblance of Srawacs at this season is large, from Mandissura, Rattam and all the large mercantile towns in central India, and I think there must exist, or have in former times existed, some caves or buildings for them to assemble in which may yet be ascertained, for the country is quite barren. Neither at the summit of the hills, nor on the road at the foot, is there any water or shelter for devotees, nor yet any building. It may not be uninteresting, and perhaps prove of utility, if I describe the road and means of access to Báwangaj and its figure. Taking Mhow as a starting point, there are two roads, one ninety and the other one hundred and nine miles long, each having its advantages; the first and shortest is by Akbarpur and the Nerbudda, and is that most likely to be taken by a traveller going towards the provinces. The distances are—from Mhow to Akbarpur, on the Nerbudda, 39 miles, from this to Chakulda, 44 miles, but by water somewhat less. I performed it in about 20 hours, going with the stream, but

sleeping during the night drawn up upon a sand bank. From Chakulda on the right bank to Bāwangaj temple, is about 8 miles, including the crossing of the river. The only benefit in travelling this road is the celerity with which you can get over the ground, it being the high road between Agra and Bombay as far as Akberpur. Beyond this it is a matter of choice whether the land route be taken *viâ* Dharampurî and Bicaner, or the water. At one of the bungalows, Googree, below the ghats, a stroll of 100 paces round the building amply repays the traveller in the innumerable specimens of lucustrine deposits, principally shells scattered curiously enough loosely over the surface, as if left there by receding water, and in profusion. The Nerbudda presents of course its own peculiarities, but beyond these there is little to attract attention. The other road is longer but full of interest almost all the way. Thirty-one miles distant is Dhar, the reputed capital of the Pramara dynasty, now on the wane, but which has preserved its name and site if nothing else, for nearly 10 centuries. On every side are tombs, musjids and palaces, evidences of the Mahomedan invaders, but now and for some time past falling fast into ruin, and being hourly despoiled to furnish materials for Brahminical temples, in return no doubt for a like compliment paid the Hindus by Dilawar Khan Ghori in 1387. We may say with no irreverence here :—"Sic transit gloria mundi." Bang, 48 miles distant on the direct road, but below the ghats, furnishes its caves, the only purely Buddhistical ones hitherto found in central India, so long the seat of Buddhistical rule, and its invariable associate, paramount religious influence. Hence to Chakulda there is nothing of interest, and there merely a bungalow, from which Bāwangaj temple can be both seen and visited, and from which it bears about 13° south-west. There being no water or shelter on the hill, must be returned to daily. It is open to the traveller to return by either route, but perhaps wiser to descend than to ascend the stream.

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*Translation of the inscription on a piece of stone on the eastern side of the temple.*

May Rāmachandra Muni, who is the receptacle of virtues, who is blessed with wealth, whose feet are adored by the circle of the lords of the earth ; whose fame is as white as the moon, the kunda flower and snow,

whose fame is represented by the temple of Indrajit Jain,\* whose fame has reached the points of the highest mountains on earth, whose fame is the greatest on the face of the earth, whose fame has in consequence of the great crowd of people on the surface of the earth gone to the sun to be crowned with success.

Dated Friday, the 14th Bhadrapad vud, Samvat 1223.

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*Translation of the inscription on a piece of stone on the southern side of the temple.*

I make my obeisance to him who has subdued his passions.

May Rámachandra Muni, who has had the beautiful temple of Surapati† built.

Who has brought all the science to light, whose fame travels all over the earth, who has renounced all evil passions, whose mind is developed by knowledge, who is revered by persons making Tapascharya, who is possessed of all the virtues, who is a descendant of the family of Shrí Devánanda Muni, the receptacle of religious knowledge, and Tapascharya, the abode of the qualities possessed by *Yatis*; the treasure of good sayings, the leader of all the assemblages of Sidhas, and who was the pupil of Lokánandamuni, the lion for destroying the elephant, consisting of the sins prevailing in the Kali Yug, and whose feet were kissed by the crown of VAIN, the Lord of the earth,—be crowned with success.

Samvat 1223.

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*Translation of the inscription on the gate of the temple.*

On the auspicious day of the 1st Mrigashirsha vadi, Samvat 1516, and during the reign of Mahmood, of the Soorsheida family, when the Shrí Kashtha† Singh, was prepared to proceed to Muttra and Pushkar, Shrí Ratnakirti, who has crossed the ocean of committing to memory the principles of the Jain religion. Who makes mental devotion. Who is the leader of the circle of Sidhas, and who is the pupil of Shrí Kamalakirti Dev, who was the chief of the speakers on the subject of the great dispute, who was the grandfather of Rayavadi, who was the leader of the circle of learned men, who

\* Shukrajit in the inscription.

† Indrajit.

‡ A particular assemblage of pilgrims.

was the pupil of the most respected Shri Hemakirti Deva, who observed all the Vratas, who constantly read the religious works, who made Tapascharya, who had curbed the passions, and who was the pupil of the most respected Shri Kshemakirti Deva, repaired the large Jaina temple.

Parashri Dashji, Navashutikagar, Kahapita Bhuderur, Dnyatyusura, Daloobharya, Khetu *alias* Padmini; Khetoo's son, by name Vadha, and Parus, have consecrated the image of Indrajit, and daily worship it; may this assemblage be happy.

*Translation of the inscription on a piece of stone on the northern side of the temple.* In Samvat 1516 \* \* \* repaired (the temple.)

*Translation of the inscription on a piece of stone on the western side of the temple.* Acharya Shri Ratnakirti Pandit Pahoo.

*Translation of an inscription on a pillar within the temple and near the gate.*

Jogi Jangam \* \* \* Maga.

The name of the artist is unintelligible. In Roman characters it is Silpa Naga Sutra Sálá—Sillupa dala Shutra Sálá.

*On the east side of the temple.*

यस्य सखतुषारकुन्दविशदा कीर्तिगुणानां निधिः श्रीमान् भूपतिहृद-  
वन्दितपदः श्रीरामचन्द्रो मुनिः। विन्ध्यस्याम्बदखर्वशेखरशिखासञ्चारिणी  
हारिणी उर्व्यां शत्रुजितोजिनस्य भवनव्याजेन विस्फूर्जति ॥ १ ॥ रामच-  
न्द्रमुनेः कीर्तिः सङ्गीर्णं भुवनं क्षिण। अनेकलोकसङ्घर्षाद्गता सवितु-  
रन्तिकं ॥ संवत् १२२३ वर्षे भाद्रपदवदि १४ शुक्रवार ।

*On the south side of the temple.*

ॐ नमोबोतरागाय । आसीद्यः कलिकाञ्जकस्य कश्चिन्सैककंटीरवो  
वेन स्थापितमौलिचुम्बितपदः यो लोकनन्दो मुनिः। शिष्यस्तस्य ससर्ववज्र-  
तिक्षकः श्रीदेवनन्दो मुनिः धर्मज्ञानतपोनिधिर्यतिमुखायामः सुवाचां  
निधिः ॥ १ ॥ वंशे तस्मिन् विपुलतपसां सम्मतः सत्त्वनिष्ठो वृत्तिं प्राप्य  
विमलमनसा ब्रह्मविद्याविवेकः। रम्यं हृद्यं सुरपतिजितः कारितं येन  
विद्या श्रेया कीर्तिं र्भनति भुवने रामचन्द्रः सद्यः ॥ संवत् १२२१ वर्षे ।

*On the gate of the temple.*

सुक्ति श्रीसंवत् १५१६ वर्षे मार्गशीर्षवदि ६ रवौ सूरसेनमेहमुन्दराज्यश्री  
 काठासन्ने मायुरगळे पुष्करमखे भट्टारकः श्रीश्रीश्रीमकीर्तिदेवः व्रत-  
 नियमस्वाध्यायानुष्ठानतपोपशुभैकनियमभट्टारकश्रीश्रीमकीर्तिदेवसच्छि-  
 य महावादवादीश्वर रायवादीपितामहसकलविद्वज्जनशक्रवर्ति-  
 नः श्रीकमलकीर्तिदेवा सच्छिष्यजिनसिद्धान्तपाठपयोधिनायकान्तरो-  
 पासीन मण्डलाचार्यश्रीरत्नकीर्तिना जोर्षोडारः कृतः सहचैत्यालयपा-  
 र्शे दशजिनवश्रतिकाहा कारोपीता भट्टेश्वर द्वितीयसं डालुभार्याखेतु  
 दि ना पद्मिनी खेतुपुत्रसं० वाढासं० पारस एतैः इन्द्रजितः प्रतिमां  
 प्रतिष्ठाप्य निम्नमर्चयन्तो पूजयन्तोवा शुभंतावच्छीसङ्गस्य ।

*On the north side of the temple.*

संवत् १५१६ वर्षे शिष्यनागसुतरसाजाशिक्षण्डाणा सूत्रशास्त्राजी-  
 र्णवतः ।

*On the west side of the temple.*

आचार्यश्रीरत्नकीर्तिपंडितपाड ।

*On the pillar of the gate of the temple.*

जोगीजंगमयाउसजोतराउन ।

*From the foot of the statue.*

कण्ठरनाथसाधु

चतुर विहतिहिनि

साकसाणा ह ह प्रबति

Kantharanátha Sádhu.

Cháturváti hí—li.

Sáka Sálá haí pranati.

*Remarks on the Snow Line in the Himalaya.*—By Captain THOMAS HUTTON.

In the Journal of the Asiatic Society, No. 202, for April 1849, are some remarks on the snow line in the Himalaya, from the pen of Lt. R. Strachey of the Engineers, wherein he endeavours to prove that the observations some years since made by myself and others in the northern tracts of the Western mountains, are erroneous.—[As it appears to me that this gentleman has actually left the question where he found it, I might have been induced to pass by his remarks without notice, had he not in the excitement of an imaginary triumph, thought proper to indulge in a somewhat satirical tone of condemnation].

That Lt. Strachey, after three or four years of scientific researches, has at length been enabled fully to *corroborate* the previous observations of Webb and others in Kumaon, there is no denying,—but as the truth of those observations when applied to that neighbourhood, was never called in question, there appears to have been a waste of time and ingenuity on a laborious endeavour to prove that which was already admitted to be an established fact.—Webb, Hodgson, Colebrooke and the Gerards, are each and all reviewed and in some measure found wanting, and pronounced to be ignorant alike of the true meaning of “the snow line,”—and of the nature of “a glacier;”—shall I then desire a better fate than to be condemned in the company of such arrant *ignoramuses*?

Had Lt. Strachey evinced *more* real anxiety to ascertain and establish,—not a local,—but the general truth,—and *less* proneness to indulge in censure, he might have gathered from my letters in the Calcutta Journal of Natural History, that no attempt was made either by me or by those gentlemen whose opinions and observations corroborated mine,—to refute the facts which Webb and others had observed in Kumaon, but that on the contrary while we admitted those facts to be true, we still thought we saw reason to conclude from what had been witnessed in other parts of the mountains, that they could be regarded only as locally and not generally true.

With regard then to the actual point in dispute, Lt. Strachey has done nothing;—for to prove that his imaginary opponents were wrong, he would have collected his data from the districts in which their ob-



servation were made ;—yet, while confidently pronouncing them to be in error,—he ingenuously informs us that he never was in those districts !\*

What then is the true value of his assertions and assumptions ? Does he imagine that the scientific world will be content to accept his unsupported '*ipse dixit*' in preference to the actual observations of four independent inquirers, each of whom is fully as competent as himself to judge of what he sees ?—Did it never occur to him that, that which may be *locally true* in one district is not necessarily true in general when applied to the whole extent of the Himalayan range ?—Into some such error did Werner fall when he regarded the geological facts of a limited German district, as an epitome of the geology of the entire globe ; and if men are wilfully determined to look no farther than the length of their own noses, such errors must needs be frequent and unavoidable.

The first objection made to my views arises evidently from my opponent's ignorance of the localities spoken of,—he, according to his own acknowledgment in a note at p. 297 of the Journal above mentioned, distinctly stating that *he never was there himself* ! Yet he does not hesitate to *assume*, that "the true Himalaya," of which I wrote, was the Bissehir or Southern Snowy range.—Had he possessed any personal knowledge of the country over which I had travelled, he would have seen that all the Passes mentioned in my letters, were situated *beyond* that range and to the north of it,—while, since he admits that "the mountains on which perpetual (?) snow is found, all lie between the 30th and 32nd degree of north latitude,"—a glance at his map would have shown him that the locality of my observations is situated between  $31^{\circ} 30'$  and  $32^{\circ}$ , or as completely beyond the Bissehir range, as his own locality is north of Kumaon.

In regard to the mistakes into which I am stated to have fallen, in confounding "the north and south aspects of the individual ridges with the north and south aspects of the chain,"—I have to observe that the mistake is due rather to my readers than to myself, for in stating that "dense forests and vegetation occur along the southern

\* Lieut. Strachey has quoted Captain Cunningham's remarks as confirmative of his own opinions, but the latter gentleman, in a recent paper, appears to plead "not guilty"—to the soft impeachment !

*slopes*, while they are nearly altogether wanting on the northern *face*,"—it is evident that I referred to the true north and south aspects of *the chain*;—whereas my opponents chose to imagine that I referred "to the north and south aspects of individual ridges;"—hence Mr. Batten's objections at page 384 of No. 19 of Calcutta Journal of Natural History, where that gentleman says,—he is "convinced that Captain Hutton confounds the singular with the plural number! viz, slope with slopes."—Had he been kind enough to imagine that it was just within the bounds of possibility that the final *s* was a slip of the pen,—he would have been much nearer the truth.—Indeed, he might have seen that such was the case from the immediately subsequent mention of "the northern *face*," in the singular, as contrasted with "the southern *slopes*."

But although Lt. Strachey has deemed it necessary to lay such stress upon what he imagines to be a grave error,—it is remarkable that he has studiously abstained from accepting the explanation of my meaning, given at p. 380 of *the same number* of that Journal, in these words,—“Captain Jack objects to my stating that ‘dense forests and vegetation occur along the southern slopes, while they are nearly altogether wanting on the northern face;’—in making this statement, I referred, *not* to the southern slopes of secondary or minor ranges on the Cis-Himalayan aspect, *but* to the fact,—that forests and dense vegetation are found *on the south of the principal chain or true Himalaya*,—while on the northern aspect of that great range they are nearly altogether wanting.—This assertion will, I doubt not, be borne out by every one who has crossed into Tartary; for while to the south of the great chain, we find superb and stately forests,—on the north there is scarcely a tree to be seen, and the few that are occasionally met with, are either stunted cypresses growing in the moist soil of ravines, or poplars planted round a village by the hand of man, for economical purposes.”

Now, as a mathematician, my opponent should have known that when a man assumes his own data, he ought to be able to prove anything he likes; and assuredly he is bound to establish the point for which he is contending: yet acting on this principle he has somehow only contrived to prove himself in error,—for, knowing nothing of the western Himalaya, and *assuming* that I mean one thing, when I have

distinctly stated that I mean another,—he proceeds to draw conclusions which will not bear a moment's examination. Had he before passing sentence of condemnation, bent his footsteps towards the upper parts of Kunawur, he would have found that forests *are not wanting to the north of the Bissehir range*, and consequently that my remarks could not apply to it as the water-shed.—It is not until the traveller surmounts the passes which lead from upper Kunawur into the Tartar districts, that he beholds on the one hand a wooded country and on the other a comparatively barren waste, and when he has consequently placed nearly the whole of Kunawur between himself and the Bissehir range to the south.

"The doctrine," says Lieut. Strachey, "which Capt. Hutton attacks as erroneous, undoubtedly is so. But it is a doctrine that was never inculcated by any one. Capt. Hutton having misunderstood the true enunciation of a proposition, reproduces it according to his own mistaken views, and then destroys the phantom that he has raised."—With all due deference to Lieut. Strachey, he must permit me to remind him that *assertion*, however confidently made,—is neither proof nor argument, and that the doctrine to which I alluded *did exist*, may be gathered from Captain Jack's letter in No. 15, p. 458 of the Calcutta Journal of Natural History, and likewise from Dr. Lord's remarks on the Hindu Kush,\* which by the way Lieut. Strachey does not deem it safe to comment upon! Moreover, "*the phantom*" which I and my supporters destroyed, was neither more nor less than this,—that whereas the common doctrine assigned *as an universal rule*, a lower elevation to the southern snow line than to the northern, we showed that it was only *partially* and *not universally* applicable. Lieut. Strachey however, having rejected the explanation of my meaning, as well as everything tending to militate against his own preconceived notions, and having himself misunderstood the true enunciation of my proposition, denies to his opponents the right of crediting the evidence of their senses, and leads them to infer that he is unwilling to admit the truth of any fact which he cannot actually see. The erroneous idea, which he has imbibed, that the Bissehir range is my true Himalaya, as he loves to call it,—is founded on an

\* Cal. J. Nat. Hist. No. 14, p. 276.

assumption arising solely from his total want of knowledge of the localities in which my observations were made.

In quoting from Captain Cunningham's letters to me, Lieut. Strachey is careful to extract only so much as may tend to corroborate his own views ; but in theorising on the probable causes which tend to accumulate a greater quantity of snow on the southern than on the northern aspect, and which he thinks he finds in the sudden congelation of moisture-bearing winds from the south, he is pleased altogether to disregard Captain Cunningham's observation that it is the violence of this same southerly wind which actually keeps the southern slopes of Tartary free from snow, and that too at all times.

Contrary to all Lieut. Strachey's views and theories, we find Capt. Cunningham writing from Tartar districts that,—“in January and February, and indeed at all times, the violent southerly winds kept southern exposures free from snow ;”—again he says, “no snow whatever on southern slopes within 15 to 16,000 feet ; but on northern slopes and in hollows, abundance of snow.” Again—“February 10th and 11th.—In getting up the northern slopes, the snow was, I don't know how deep ! On reaching the summit of a pass I found no snow, nor did I find any on the southern slopes, except in hollow portions or tolerably flat bits.—The highest pass on the road is perhaps 13,500, or nearly 14,000 feet.”—[This too, be it remembered, in notoriously the severest month of winter, in these hills !] “The effect,” he continues, “is attributable partly to the violent southerly winds which blow during December, January and February, and partly to the sun's rays. In the beginning of May, in coming from Nako to Chungo in Hungrung, I found no snow on the southern, eastern or western slopes ; but on some northern ones which were steep, there was snow three and four feet thick ; elevation about 11,500 feet. At Shalkur up to the middle of June, the snow lay on the northern sides of the gullies or ravines of the hills ; and when out shooting I had much difficulty in crossing them ; elevation 11,000 to 11,500 feet.—I was informed also that the northern slopes of the Hungrung ghat, between Soongnum and Hunge, had some snow until the middle of June. On the southern face it had melted six weeks before, except in hollow places.” And finally, “August 7th.—There is no snow on western slopes of hills 17,000 feet high, but there are a few patches on the northern slopes.”

Thus we have observations made in Tartar regions north of the Bissehir range, between  $31^{\circ} 30'$  and  $32^{\circ}$  north latitude, all of which tend directly to prove that while from December to August snow was always to be found on the northern aspect of every hill or range, there was either little or none at all on their southern exposure.

What, then, has Lient. Strachey proved by his observations in Kumaon, and by his strictures upon nearly every one who has written on the subject of the snow line in the Himalaya? We appear to be indebted to him simply for proving what was never disputed, namely, that the facts observed by Webb and others in Kumaon are true, as far as regards that district; but with respect to the only point in dispute, namely, as to whether those facts are only locally and not generally true, he has left the question exactly where he found it. Indeed, his *assumption* that my observations were confined to the Bissehir range, in spite of my declaration to the contrary, proves at once that his efforts have been less directed to the elucidation of the truth, than to my personal discomfiture.

But conceding even that the Bissehir or southern snowy range was the locality on which my facts were observed, there still appears strong reason for asserting that the phenomena there visible are directly opposed to the conclusions which my opponent would draw from them; for he declares that a greater quantity of snow must fall on the outer southern face of the range, owing to the interception of heated and moisture-bearing winds from the south, and thus he would account for the prevalence of the snow on that aspect. Supposing then, for the sake of argument, that thus far his views are just, when applied to the southern range of Kumaon, he has still chosen to overlook the fact that in Lord and Gerard's "*Tours in the Himalaya*,"—a work too, which he has himself quoted,—it is stated that "the line (of perpetual snow) in the latitude  $30^{\circ} 30'$  in Asia is fixable at 15,000 feet on the southern or Indian aspect of the Himalaya mountains, and on the northern (not the Tartaric) may be concluded at 14,500 feet."—This appears to me to give the northern snow line of the outer range an elevation less by 500 feet, than the southern one; while Captain Cunningham in a recent paper, even estimates the approximate difference at 3,000 feet.\*—The same gentleman likewise states that—"on the

\* J. A. S. No. 205, p. 695, for 1849.

Tibetan side of the chain the (approximate) heights will be found to be 20,000 feet on the south, and 18,000 to 18,500 feet on the north face of the same hill."—These observations then appear to establish the fact that from the southern snowy range to the northern or Tibetan one, the snow line is always, on every hill or range, the outer ones inclusive, at a lower elevation on the northern than on the southern slopes.

But Gerard proceeds to tell us, that "the cheeks (of the Borendo pass, on the Bissehir range) are perfectly naked long before this time of the year (August 1822,) and the trough formed by them, although sheeted with snow at the summer solstice, is now (August) bare rock down to the ravine *on the south side*, with the exception of some accumulations, which will be very much diminished before another month; and some seasons, as in the former (1821.) *the whole face of the declivity without a patch of snow*. On the north, *there lies a vast field which never dissolves*."\*

So again, Captain Jack says,—“I crossed the Borendo ghat on the 25th September 1842, and *there was no snow at all on the southern aspect*, or on the very summit of the pass; but descending a few yards *on the northern aspect* to the base of a rock which was nearly perpendicular, we had the pleasure of seeing our baggage, coolies, &c. descending most rapidly by their own gravity *upon an unbroken bed of snow extending 250 to 300 yards in one slope*, forming an angle of about 45°.”

Here then, we have different observers in different years proving that on the Bissehir range, the snow lies deeply and extensively *on its northern face*, even when there is *none on the southern aspect*; we have consequently the very same phenomena apparent, from the outer snowy range up to the northernmost one, proving that the local facts of Kumaon are *not facts* in the western parts of the Himalaya, and showing moreover, since the true southern aspect of *the chain* becomes denuded of snow,—that while there is a snow line on the northern or Tibetan aspect, there is no permanent snow line on the southern face of the Bissehir range.

It is however due to my opponent to state, that I am not aware that the elevation of the passes on the Bissehir range have ever been correctly ascertained, for although Dr. Gerard has somewhere stated the

† Loyd and Gerard's tours in the Himalaya, p. 327.

cheeks of the Borendo pass to be upwards of 16,000 feet, yet the truth of that measurement has been since called in question. It may therefore eventually be found that the elevation of that pass is below the snow line, which would account for the disappearance of the snow from the southern aspect. I am quite willing then to give Lieut. Strachey the benefit of the doubt; while at the same time should I be driven from my position in Bissehir, I shall still take my stand with Dr. Lord, on the Hindu Cush, and maintain, (which is in fact the only point for which I have really contended) that the doctrine on which Humboldt relied as applicable to the whole extent of the Himalaya,—cannot be so accepted.—Feeling satisfied that he had discomfited all former observers in India, and thus converted his local into general facts, Lieut. Strachey next proceeds to run a tilt with Humboldt himself, who had accounted for the greater elevation of the snow line on the north of Kumaon, by supposing that the radiation of heat from the plains of Tibet contributed mainly to produce that effect. With this very simple and natural inference, our author is dissatisfied, and he “therefore attempts to supplant it with a theory of his own. He says, that as radiation from the plains of Tibet *does not* produce the greater elevation of the northern snow line, that effect must be occasioned by the diminished quantity of snow that falls on the northern, as compared to the southern part of the chain.” Now this, if it be intended to apply likewise to the district of Bissehir, becomes a perfect riddle, for if less snow falls on the north than on the south, how is it that there is always snow on the northern long after it has disappeared from the southern aspects of the higher ranges of the western tracts? Are we to believe that the greater the quantity, the sooner it melts?

Even if restricted to the neighbourhood of Kumaon, the theory would be totally unsatisfactory, for the small quantity of snow on the north, if not acted on by radiation of heat from the plains of Tibet, nor melted by the rains of the monsoon, would last at the very least as long as double the quantity on the southern slope, where it is exposed both to the direct rays of the sun and to the destructive influence of the heavy periodical rains; and this appears to be very satisfactorily proved by Lieut. Strachey's own remarks on the black range, which rising immediately from the plains of Tibet, retains snow on its northern aspect when there is none whatever on the south.—But when to the

effects of the above agents we add the fact that the violent southerly winds of winter have a tendency to keep the southern slopes free from snow and to accumulate it in drift on the north, we appear to have every fact leading to the conclusion that the snow will, as a general rule, be found longer and deeper on the north than on the south; and Captain Cunningham has stated that when (even in winter) there was little or no snow on southern aspects, it was sometimes "*four feet thick*" on the north!

The very admission therefore that the northern destructive agents exert little influence on the snow, would of itself be sufficient to overthrow thus much of Lieut. Strachey's theory; for if those agents which drive the snow to a certain elevation are removed, it is evident that the snow, whether much or little, must remain nearly or altogether intact.

We are further told that, "the air that comes up from the south, no sooner reaches the southern boundary of the left of perpetual snow, where the mountains suddenly rise from an average of perhaps 8,000 or 10,000 feet, to nearly, 19,000 or 20,000, than it is deprived of a very large proportion of its moisture, which is converted into cloud, rains or snow, according to circumstances.—And the current in its progress to the north, will be incapable of carrying with it more moisture than is allowed by the very low temperature to which the air is of necessity reduced in surmounting the snowy barrier, 19,000 or 20,000 feet in altitude, that it has to pass. Nor can any further condensation be expected at all comparable in amount to what has already taken place, as it would manifestly demand a much more than corresponding depression of temperature; and this is not at all likely to occur, for the most elevated peaks being situated near the southern limit of perpetual snow, the current on passing them will more probably meet with hotter than with colder air."

I must confess that this theory does not appear to me to be either conclusive or even probable; for in the first place, we are neither furnished with any *proof* that the air will be *hotter* to the *north* of the high peaks, nor with any approach to data for determining the question; the whole resting upon the unauthorised *assumption* of a *desired fact*, the existence of which is absolutely necessary to give anything like validity to the theory.



Were the upward or northward passage of the moist air effected slowly and gently, no doubt we might expect a heavier fall of snow on the southern aspect of the chain, *provided always* the temperature beyond it was, as Lieut. Strachey supposes, *hotter* than on the Indian side; but *this is not the case*, as is most convincingly proved by the admission that snow always lies longer on the northern aspects of *all hills and ranges*, than on the south, and I need only cite Lieut. Strachey's own black range as an instance of the fact.—He likewise admits that "southerly winds blow throughout the year over the Himalaya," and "in the winter," which is of course the season of snow, "*with the peculiar violence.*" This is recorded also by Gerard and by Captain Cunningham, and every traveller can confirm the same. But this very violence of the southern winds must necessarily carry the snow across the southern range and accumulate it deeply to the north, and this is clearly shown to be the case by Captain Cunningham, who relates that while during winter and "indeed at all times, the violent southerly winds kept southern exposures *free from snow*"—"on the north it was I don't know how deep." Moreover, if the temperature of the air was hotter to the north than to the south of the high peaks, we ought as we approach the plains of Tibet to find no snow on the northernmost range; yet the black range, rising from those plains retains the snow on the northern even when there is none on the southern slope,—a fact which, while it militates strongly against Lieut. Strachey's views, tends much to corroborate Captain Cunningham's observations. But granting that Lieut. Strachey were correct in these particulars, does it necessarily follow that what is fact in the neighbourhood of Kumaon, may not be pure fiction when applied to the western tracts? Can the assumptions of one who confesses that he never set foot within the limits of the district where his opponent's observations were made, in any way affect those observations? He is evidently disposed to disregard the question of one of his own supporters, who asks—"how can any facts of one observer in one place falsify the facts of another observer in another place?"\* Now I and my supporters have long since received Captain Webb's Kumaon facts *as true*, when applied to the places wherein he observed

\* Cal. Journ. Nat. Hist. No. 19, p. 383.

them, and we merely in return claim the right of believing the evidence of our own senses, when wandering over other tracts of the Himalaya.

I repeat then, that as far as the evidence yet goes, the phenomena observable in Kumaon are opposed to those which have been observed to the westward,—and in rejecting Lieut. Strachey's theory as insufficient, I much prefer adhering to Humboldt's until a better is offered. Lieut. Strachey denies that the radiation of heat from the plains of Tibet exercises any but a trifling influence on the snows of the northern aspect; still his denial rests on no better basis than that of an assumption, for no proof whatever is produced in support of the opinion, save that there is snow on the Tibetan face of the black range, when there is none on the southern face.—But this is really nothing to the purpose, for it merely shows that the direct rays of the southern sun, united to the greater humidity of the atmosphere, and the effects of the violent southerly winds, have a far more powerful effect in uncovering the southern aspect, than the heat from the plains of Tibet has upon the snow of the north. The true question however does not relate to the north and south aspect of the black range, but to the aspects of the water-shed; and in regard to it we are told that while on the south the snow line is about 15,000 or 15,500 feet, on the north it is 18,000 to 19,000 feet. Now the height of the northern ranges above the plains of Tibet does not appear, on an average, to be more than 3,000 to 8,000 feet, if so much; while on the south, the peaks rise to 16,000 and 18,000 feet above the plains of India, from which moreover they are separated by a broad intervening belt of wooded mountains, averaging from 6,000 to 8,000 feet above those plains. Consequently it does not appear very difficult to perceive that radiation from the northern plains, must affect the snow more powerfully than from the southern plains, and will drive the snow line to a greater elevation *above the sea* on the northern, than on the southern aspect. Thus Humboldt's theory when applied to the Kumaon and other similar districts, appears to be perfectly correct. But that the physical features of the Kumaon and western tracts are at the antipodes of each other, has been plainly stated by Mr. Batten, who says—"our passes *at once* take us into Tibet, and do not conduct us like those beyond Simlah, into an intermediate and peculiar track, like Kuma-

wur.”\* Now it seems to me by no means improbable that this very difference in the features of the two tracts may be sufficient to account for the difference in the phenomena observable in each, and that if Humboldt’s theory of radiation from the plains of Tibet is sufficient to account for the retreat of the snow to the heights of the northern face, the want of similar plains† in the western tracts will of course preclude such radiation from acting on the northern face of the western mountains, and thus the greater heat of the southern side, added to the periodical rains and to the violence of the winds in winter, will leave snow on the northern long after it has disappeared from the southern aspect.

Lieut. Strachey admits that the rains have a powerful effect in melting the snows, but his want of knowledge of the localities to the westward has led him into an error when he supposes that the monsoon does “not extend up the Sutlej beyond the point where the Buspa falls into it;” the truth being that Chini, which is itself farther up and situated in the gorge where the Sutlej breaks through the outer snowy range, is full within the monsoon, as both Captain Jack and I experienced; beyond this point the rains are light and uncertain, but they nevertheless extend to the head of the district, for clouds and vapours pass onwards through the valley of the Sutlej even to the upper parts of Kunawur, and exercise great influence in clearing the southern slopes of their snow; and although Lieut. Strachey has *assumed* that clouds protect the snow, by warding off the direct rays of the sun, he overlooks the fact that such clouds betoken a humid atmosphere, which is quite as inimical to the duration of the snow as the sun’s rays, and he might at least during his scientific researches in Kumaon, have learnt the fact that thaws are more rapid in cloudy weather, than in a dry and unclouded atmosphere, such as that which he acknowledges to be the general characteristic of the northern aspect.

Dr. Lord’s remarks on the Hindu Cush coincide apparently with mine to the north of the Bissehvir range, and since Webb’s observations in Kumaon are found to be only locally true, there can be little doubt

\* Cal. Journ. Nat. Hist. No. 19.

† Captain Cunningham seems to doubt the existence of any plains at all!—Vide J. A. S. 205, for 1849.

that Dr. Lord's surmise relative to the effect of heat radiating from the high plains of Cabul and Koh-i-damun is correct.

In regard to "*perpetual snow*," Lieut. Strachey has rightly understood me, and I again repeat that *there is not* and *cannot be* any such thing, and that any assertion to the contrary must necessarily convict its author of being utterly ignorant of the well known fact, that nothing in nature is perpetual or everlasting. All matter is ever undergoing change; the very rocks are crumbling down beneath the force of atmospheric agents; the atmosphere itself is constantly undergoing change and renovation; the water and the snow alike return to it in the form of vapour. Where then is there a sign of perpetuity? My opponent should have remembered, when he undertook to censure my supposed illogical reasoning, that there is a wide difference between a hill covered with *perpetual snow*, and one that is *perpetually covered* with snow!—"The mere continuance of snow on any spot," says no less authority than Professor Forbes, "does not suppose that snow never melts there; were that the case a progressive and unceasing accumulation would be the result; the position of the *snow-line*, or what is often erroneously called *the line of perpetual congelation*, is determined solely by this circumstance, that during one complete revolution of the seasons or in the course of one year, the snow which falls is just melted and no more."\*

Thus Lieut. Strachey's observations, although useful in corroborating those of Webb and others, in reality leave the question precisely where it was, namely, that while in Kumaon the elevation of the snow line is greater on the northern aspect than on the southern; the truth, on the Hindu Cush, and as far as observation goes, in the Tartar districts north of the Bissehir range, is actually the reverse; proving as I long since stated, and now repeat, that the facts on which Humboldt relied as applicable to the whole extent of the Himalaya, are found to be purely local, and dependent altogether on the physical features of the country to the north and south of the water-shed.

\* Forbes' Travels through the Alps, p. 18.

*Corrections to notes on Land and Fresh Water Shells, collected in Afghanistan. By Capt. THOMAS HUTTON.*

By a letter lately received from W. H. Benson, Esq., I find that the following corrections are required to my notes on Afghan shells, published in the July number of this Journal for 1849 ; many changes having lately taken place in regard to the names bestowed by writers in India.

No. 1. for "*Parmacellus*"—read "*Parmacella*."

No. 4. *Helix Bactriana* (Hutton). Dr. Pfeiffer regards this as only a variety of the European *H. strigella*.

No. 8. *Pupa spelcea* (Hutton). According to the present classification this will stand as *Bulimas spalceus* (Hutton), unless it has been previously published by Mr. Benson as *B. eremita*.

No. 9. *Pupa Indica* (Benson's Mss.)

*P. cylindrica* (Hutton), now stands as *Bulimus pullus* (Gray).

No. 10. *Pupa cænopicta* (Hutton), is now *Bulimus cænopictus*.

No. 11. for "shell convid"—read "*Shell conoid*."

No. 16. *Melania elegans* (Benson), is now *M. spinulosa* (Lamarck).

No. 17. *M. pyramis* (Benson), is *M. tuberculata* (Muller).

*On the Aborigines of the Eastern Frontier.—By B. H. HODGSON, Esq.*

In continuation of my papers already submitted to the Society having in view to exhibit summarily the affinities of all the aborigines of India, I now submit Vocabularies, uniform with their precursors, of the written and spoken Burman, the Singpho, the Nága in three dialects, the Abor and the Miri tongues.

For this series I am indebted to the Rev. N. Brown of Sibsagor, who in forwarding it to me favoured me with the following remarks :—

"These specimens appear fully to establish the fact that the *Burman*, *Singpho*, *Nága* and *Abor* languages are very close relatives, and ought not to be separated into different families, as they sometimes have been. The Burman and Singpho, it is true, have been regarded as nearly related ; but I am not aware of its ever having been supposed that the Nága or Abor were closely related to the Burman, or that there was any

very intimate connexion between the two. The Nága tribes are very numerous, and every village appears to have its own dialect.

I have not inserted the Khamti or Shyán because I am not convinced that there is any very close radical connection between either and the Burmese. This affinity seems always to have been taken for granted as a matter of course, but without any just ground. It is true there are a considerable number of Burman words in the Khamti, but they bear the marks of recent introduction, and are not to be found in the old Ahóm, the parent Shyán, nor in the Siamese, with which the Ahóm was nearly, if not exactly, identical. I have inserted the Burmese as *written* together with the spoken *form*. The Mags of Arakán, it is said, pronounce it *as it is written*, and not like the Burmese. It appears to resemble the Tibetan considerably. The 1st column of Abor Miri I have collected from a vocabulary published a year or two ago by Captain E. F. Smith (of the Bengal Native Infantry), commanding at Sadiya.—The last column I got from a Miri residing at this place.

In Burman I have used *th* to express the sound of *th* in *think*. Also a stroke under the initial letter of a syllable to denote the falling tone, and a dot under the final vowel to denote the short, abrupt tone. The Singpho and Namsang Nága are taken from a vocabulary published several years ago by the Rev. M. Bronson, and may be depended on as correct. The other two Nága dialects are given by two men from villages near Nowgong—the only Nágas I can find in the station just now; and, as they do not understand Asamese very well, I may have introduced some errors from them. At all events, the words are evidently encumbered with affixes and prefixes that do not properly belong here. I have not however ventured to remove any of them, as you will be better able to do this. I am inclined to think that the radical forms in all these languages are monosyllabic, as the Burmese unquestionably is. The verbs, &c. would probably show a much greater resemblance if we had all the terms for each idea; as there will generally be many verbs nearly synonymous; consequently the lists do not always exhibit the corresponding forms; thus creating an apparent difference when there is none in reality."

As it is not my purpose to anticipate the results of the present inquiry, I will add nothing on this occasion to the above obliging and sensible remarks of Mr. Brown.

| English. | Burman,<br>Written. | Burman,<br>Spoken. | Browson's<br>Singpho. | Browson's<br>Namsang<br>Naga. | Nowong<br>Naga. | Tengsa<br>Naga. | Capt. Smith's<br>Aber-Miri. | Sibesgor<br>Miri. |
|----------|---------------------|--------------------|-----------------------|-------------------------------|-----------------|-----------------|-----------------------------|-------------------|
| Air      | lé                  | lé                 | mbung                 | póng                          | mabung          | mapung          | asar                        | esár              |
| Ant      | purwakchhit         | payuetelk          | gagin                 | tsipchák                      | machá           | mathán          | mirang                      | meráng            |
| Arrow    | swá                 | myá                | pela                  | láchan                        | lassang         | lasan           | epuk                        | epug              |
| Bird     | nghak               | nghet              | wa                    | vó                            | thsz            | usó             | pettang                     | pátang            |
| Blood    | swé                 | thwé               | sei                   | hé                            | asú             | ái              | yilpi ul                    | lye               |
| Boat     | lhé                 | lhé                | li                    | khunokhó                      | surung          | lung            | ellóng                      | dílungá           |
| Bone     | aró                 | ayó                | nráng                 | áráh                          | terap           | telet           | flong                       | flong             |
| Buffalo  | kwe                 | kyue               | ngá                   | lé                            | chang           | tyang           | menjek                      | menjé             |
| Cat      | krong               | kyang              | ningyan               | miang                         | taut            | meyau           | mendari                     | menkuri           |
| Cow      | swá                 | swá                | kansu                 | mán                           | nasí            | mási            | gúrúshameh                  | górú              |
| Crow     | kyi                 | kyi                | kokhá                 | vakhá                         | waru            | walo            | piák                        | púag              |
| Day      | né                  | né                 | ningthól              | rangyi                        | ....            | tunglá          | longeh                      | longto            |
| Dog      | thwé                | thwé               | gui                   | hú                            | azz             | arh             | eki                         | iki               |
| Ear      | ná                  | ná                 | ná                    | ná                            | tenanung        | telánna         | norong                      | yerung            |
| Earth    | mré                 | myé                | nggá                  | há                            | áli             | áli             | ámong                       | ámong             |
| Egg      | u                   | u                  | údi                   | ats                           | antau           | utú             | ápu                         | apú               |
| Elephant | chhang              | s'hen              | magui                 | puok                          | shifí           | sutí            | sita                        | síto              |
| Eye      | myakchi             | myetái             | mi                    | mit                           | tenok           | tenyik          | amík                        | amík              |
| Father   | phaé                | piá-é              | wá                    | vá                            | upá             | apu             | yiai                        | bábá              |
| Fire     | mi                  | mi                 | wan                   | van                           | mf              | masí            | eme                         | umme              |
| Fish     | agá                 | agá                | nga                   | ngá                           | angu            | angu            | engo                        | orgo              |
| Flower   | pan                 | pan                | siban                 | chóngpó                       | naru            | nolong          | ápu                         | ápu               |
| Foot     | khre                | khre               | lagóng                | dá                            | tatóng          | taching         | álo                         | álo               |
| Goat     | chhit               | s'heik             | bainam                | kien                          | nabung          | nabung          | shuben                      | agóli             |
| Hair     | chhanbang           | s'haben            | kará                  | kechó                         | kó              | ku              | dumit                       | dumed             |
| Hand     | lak                 | let                | lettá                 | dak                           | takhá           | tekhat          | álák                        | elág              |
| Head     | hong                | ghaung             | bóng                  | khó                           | takolák         | teko            | tuke, mittak                | mittab            |
| Hog      | wak                 | wak                | wá                    | vak                           | ák              | ák              | yúek                        | eyeg              |
| Horn     | kyo                 | ghyó               | rung                  | róng                          | tsatú           | tái             | áreng                       | áreng             |
| Horse    | marang              | myen               | gumrang               | mók                           | kórr            | kuri            | góre                        | gure              |
| House    | im                  | eing               | ntá                   | hum                           | kí              | kí              | okum                        | okum              |

| English. | Burmese,<br>Written. | Burmese,<br>Spoken. | Bronson's<br>Singpho. | Bronson's<br>Namsang<br>Naga. | Nowong<br>Naga. | Tengsa<br>Naga. | Capt. Smith's<br>Abor-Miri. | Sibesgor<br>Miri. |
|----------|----------------------|---------------------|-----------------------|-------------------------------|-----------------|-----------------|-----------------------------|-------------------|
| Iron     | san                  | thán                | mpri                  | jan                           | yín             | yén             | yegurah                     | yogir             |
| Leaf     | rwak                 | yuet                | láp                   | nyáp                          | tángurh         | ám              | anné                        | ekamane           |
| Light    | lang                 | len                 | singthói              | rangyó                        | nyesung         | sanggho         | piutáng                     | púda              |
| Man      | lá                   | lú                  | singpho               | minyán                        | shitsü          | suchí           | amie                        | ámme              |
| Monkey   | myok                 | myauk               | wóé                   | véh                           | yítá            | lutá            | shibeh                      | shibe             |
| Moon     | la                   | lê                  | sítá                  | dá                            | nú              | uchá            | paló                        | polo              |
| Mother   | ami                  | ami                 | bam                   | ingyóng                       | min áram        | masan           | namu                        | náná              |
| Mountain | tong                 | taung               | ninggép               | hábó                          | tepang          | tabáng          | ádi                         | ádi               |
| Mouth    | nhep                 | nhók                | tsigrong              | tun                           | merila          | anjáng          | napang                      | napung            |
| Musquito | khyang               | khyen               | míng                  | manng dóng                    | tenung          | tenyíng         | songgou                     | tanig             |
| Name     | amiá                 | ami                 | siná                  | rangpan                       | sunu            | ásangdi         | ánin                        | ánin              |
| Night    | nyin, nya            | nyin, nyá           | nam án                | tánthí                        | tótü            | mángá           | kamogah                     | kammo             |
| Oil      | achhi                | s'hí                | lunga                 | kieke                         | tsütsü          | tilá            | tuláng                      | tuláng            |
| Plantain | ngbakpyo             | nghepyo             | khá                   | jón                           | tsütsü          | móngo           | kópagü                      | kopage            |
| River    | mrach                | myit                | khá                   | lam                           | tsütsü          | tilá            | asie                        | abunge            |
| Road     | lam                  | lán                 | khá                   | sum                           | lemang          | unglan          | lambeü                      | lámto             |
| Salt     | chá                  | s'há                | jum                   | akhsun                        | matü            | machi           | álu                         | álo               |
| Skin     | séré                 | tháyé               | phi                   | sum                           | takap           | takap           | dumóer                      | asig              |
| Sky      | swógh                | wó                  | nu                    | rángtung                      | mabat           | phumchíng       | teong                       | domtir            |
| Snake    | mrwé                 | myué                | lapú                  | pá                            | pürr            | phali           | ....                        | tábbe             |
| Star     | kra                  | kye                 | sigan                 | merik                         | pitinu          | lutíngtíng      | tákár                       | tákár             |
| Stone    | kyok                 | kyauk               | nlung                 | lóng                          | lungzük         | lungmanggo      | iling                       | iling             |
| Sea      | né                   | né                  | ján                   | sán                           | ánü             | tinglü          | dunús                       | doanyo            |
| Tiger    | kyá                  | kyá                 | siróng.               | sá                            | kayí            | khü             | simlü                       | ále               |
| Tooth    | swá                  | záwá                | wá                    | pá                            | tabu            | tapu            | spáng                       | ále               |
| Tree     | apang                | apon                | phun                  | bang                          | yüm             | sangtang        | éing                        | ising             |
| Village  | rwá                  | yua                 | mereng                | há                            | yam             | yam             | duílong                     | dólong            |
| Water    | ré                   | yé                  | ntala                 | jó                            | tsü             | tü              | ásá                         | sohe              |
| Yam      | myok                 | myauk               | nai                   | hákhuon                       | shí             | chun            | ngunü                       | álie              |
| I        | ngá                  | ngá                 | ngal                  | ngá                           | shí             | ngal            | ngo                         | ngo               |
| Taou     | naag, mang           | nan, man            | naag, ní              | hangma                        | ná              | hang            | naa                         | na                |



| English. | Burman Written. | Burman, spoken. | Bronson's Singpho. | Bronson's Nemsang Naga. | Nowong Naga. | Tengsa Naga.  | Capt. Smith's Abor-Miri. | Sibsaigor Miri. |
|----------|-----------------|-----------------|--------------------|-------------------------|--------------|---------------|--------------------------|-----------------|
| He       | sá              | thá             | khá                | até                     | pá           | pá            | bá                       | ba              |
| She      | ditto           | ditto           | ....               | ....                    | pá           | pá            | no                       | ....            |
| It       | ....            | ....            | ....               | ....                    | annok        | akhala        | ngolu                    | ngoda           |
| We       | ngátó           | ngadó           | í                  | níma                    | nátara       | nakhala       | nolu                     | soludin         |
| Ye       | naugtó          | naugó           | nithang            | némá                    | ka           | tebepá        | bülü                     | füllü bülu      |
| They     | sátó            | thádó           | khíaf              | seing                   | ya           | ngaichi       | ngoke                    | ngokte          |
| Mine     | ngái            | ngái            | ngóná              | ngá                     | ná           | meebi         | nokte                    | nokte           |
| Thine    | maní            | mení            | násá               | má                      | pá           | páchi         | bükte                    | bükte           |
| His      | súi             | thúi            | khíná              | até                     | ásan         | akhall        | ....                     | ngolikke        |
| Ours     | ngátóí          | ngedóí          | ....               | ....                    | sú           | nakhala       | ....                     | nolákke         |
| Yours    | mangtóí         | mendóí          | ....               | ....                    | pári         | páli          | bülüke                   | bülükke         |
| Theirs   | sátóí           | thádóí          | ....               | ....                    | katang       | khatsu        | ako                      | átéro           |
| One      | tach            | tít, ta         | almá               | vántshé                 | anna         | ánnat         | aniko                    | ngoye           |
| Two      | nhach           | nhit            | nkhong             | ványí                   | ásam         | ásam          | aomko                    | auna            |
| Three    | zung            | thóng           | masám              | vánram                  | pezar        | phálo         | apiko                    | ápíe            |
| Four     | lé              | lé              | meis               | bell                    | pungu        | phungu        | pilingoko                | üngo            |
| Five     | agá             | agá             | mangá              | hangá                   | tarok        | thelok        | akeko                    | átunge          |
| Six      | khayok          | khayuk          | krá                | frók                    | tanet        | thanyet       | kanitko                  | kunide          |
| Seven    | khwan nhach     | khunnhit        | sinít              | ingit                   | to           | thesep        | punitko                  | piaye           |
| Eight    | rhach           | shyit           | matnat             | sat                     | taku         | thaku         | konangko                 | konáge          |
| Nine     | ko              | ko              | tsakhá             | ikhu                    | tarr         | thelu         | tingko                   | üyinge          |
| Ten      | chhe            | a'he            | ái                 | fehi                    | matüü        | machi         | irilingko                | üyinge          |
| Twenty   | nhachohhe       | nhits'he        | khún               | ruakngi                 | ....         | machi lithelu | üing somko               | üying anyiko    |
| Thirty   | sungohhe        | thónghe         | tamái              | ruakram                 | liri         | meang annat   | üing apie                | üying aumko     |
| Forty    | béohhe          | léhe            | mláf               | ruakbelf                | thanam       | meang annat   | ....                     | üying apiko     |
| Fifty    | agáchhe         | ngáhe           | mangáf             | ruakbungá               | ....         | té thiulu     | ....                     | üingo üyingko   |
| Hundred  | tará            | tayá            | latasá             | oháthe                  | rokrü        | meung phan-   | ....                     | üying üyingko   |
| Of       | i (amix)        | i               | na (amix)          | wanting                 | ....         | ....          | met                      | lope            |
| To       | á               | á               | fo                 | nang                    | tang         | nai           | telópu                   | lokte           |
| From     | ka              | ga              | ....               | ....                    | ....         | ....          | odánakang                | ....            |

| English.  | Burman,<br>Written. | Burman,<br>Spoken. | Brownson's<br>Singpho. | Brownson's<br>Namsang<br>Naga. | Nongong<br>Naga. | Tangsa<br>Naga. | Capt. Smith's<br>Abor-Miri. | Sibacgor<br>Miri. |
|-----------|---------------------|--------------------|------------------------|--------------------------------|------------------|-----------------|-----------------------------|-------------------|
| By        | phrang              | phyen              | ....                   | ....                           | wá               | nú              | umnus                       | appinge           |
| With      | nhang               | nhen               | ....                   | ....                           | yasú             | stuga           | ....                        | logolo            |
| Without   | .....               | .....              | ....                   | ....                           | .....            | .....           | ....                        | ....              |
| In        | nhaik               | nhaik              | kátái                  | hum nyu                        | lóng             | atap            | árang                       | áráo              |
| On        | pomhá               | bomhá              | lethá                  | akhónang                       | talak            | tathak          | tró só                      | talúlo            |
| Now       | yakhu               | yakhu              | yá                     | dótko                          | tang             | thong           | supáb                       | su                |
| Then      | thó akhá            | thó akhá           | ....                   | ....                           | tas au           | kabáng          | ....                        | kojo              |
| When?     | bhesokhá            | bhes/okhá          | ....                   | ....                           | kódang           | kápá            | ....                        | údiilo            |
| To-day    | yané                | yané               | yango                  | matu suanta                    | tanna            | thanglu         | ....                        | silo              |
| To-morrow | nakphan             | netphan            | dsinf                  | tájá                           | asóng            | ásang           | ....                        | yampo             |
| Yesterday | yamanné             | yamanné            | maní                   | ninap                          | yashí            | ósi             | ....                        | melobo            |
| Here      | simhá               | simhá              | náde                   | maná                           | yóog             | iga             | sho                         | so                |
| There     | hómhá               | hómhá              | tode                   | anang                          | aunchi           | ótiga           | ....                        | tilo              |
| Where?    | bhemhá              | bhemhá             | gadégul                | dinang                         | kóng             | ótiga           | ....                        | okolon            |
| Above     | apo mhá             | apo mhá            | ning tsang             | makóá                          | talak            | talak           | ungkolo                     | talúto            |
| Below     | okmhá               | okmhá              | kátái                  | akhónang                       | tsang            | tachung         | rumking                     | rúmkúbe           |
| Between   | akrámhá             | akrámhá            | ....                   | akhannang                      | kiná             | ulam            | radang                      | áráso             |
| Without   | prángmhá            | prángmhá           | ....                   | vákánang                       | kiná             | má              | lulo                        | rangongolo        |
| Within    | atwang              | atwen              | ....                   | ....                           | talóng           | atap            | áráso                       | áráso             |
| Far       | wé                  | wé                 | tsán                   | háló                           | talang           | lángá           | ....                        | modó              |
| Near      | ní                  | ní                 | tsán                   | therkó                         | tatsaka          | annanglá        | ....                        | ánúnee            |
| Little    | chhitkhalé          | seikthalé          | ní                     | therkó                         | ishika           | tesu            | aninda                      | ájoda             |
| Much      | swá                 | swá                | katsí                  | achá                           | ayúka            | tobe            | ....                        | ábako             |
| How much? | bhelok              | swá                | lo                     | siá                            | kayúka           | kabekat         | eriko                       | údiuko            |
| As        | kesó                | bhelauk            | gadéma                 | chento                         | ....             | ....            | ....                        | ....              |
| So        | ló, só              | gshó               | ....                   | ....                           | ....             | ....            | ....                        | sempidang         |
| Thus      | thóshó              | ló, só             | ....                   | ....                           | ....             | ....            | dephú, au                   | tempe             |
| How?      | bhesó               | thóshó             | ndalst                 | árang                          | ányakáng         | atti            | pua                         | kápú              |
| Why?      | bhesuló             | bhesó              | ....                   | ....                           | kótan            | kalikang        | kánpida                     | kappú             |
| Yes       | hethé               | bhesuló            | fári                   | rétó                           | kashia           | kadó            | okkiduna                    | u                 |
| No        | mabut               | hóthe              | raia                   | idanga                         | au               | nongo           | ii                          | má                |
|           |                     | mabók              | galai                  | má                             | mao, nonga       |                 | mámá                        |                   |

| English.   | Burmese,<br>Written. | Burmese,<br>Spoken. | Brownson's<br>Singpho. | Brownson's<br>Nemang<br>Naga. | Nungong<br>Naga. | Tengas<br>Naga. | Capt. Smith's<br>Abor-Miri. | Sibesgor<br>Miri. |
|------------|----------------------|---------------------|------------------------|-------------------------------|------------------|-----------------|-----------------------------|-------------------|
| No, not    | ma (pu) nhang        | ma (pu) nhen        | ng, phung              | nak                           | (tók) n' (ahi)   | (tha) m' (thi)  | loka                        | yoka              |
| And, also  | lía kóng             | kíngung             | ....                   | ....                          | ....             | ....            | ain                         | ....              |
| Or         | sómahut              | hómahók             | ....                   | ....                          | ....             | ....            | ....                        | ....              |
| This       | f, sin               | f, thí              | ndai                   | ára                           | yás              | igkáká          | sí, ísai                    | shidebula         |
| That       | thó, hó              | thó, hó             | orawá                  | irapá                         | auechika         | áchika          | thna                        | ullubulla         |
| Which?     | abhe                 | abhe                | gadénuá                | mapá                          | yákung           | kachi           | ing kóno                    | okolone           |
| What?      | abhe                 | abhe, bhá           | phakeimá               | chená                         | kachinár         | chaba           | ingtua, ong<br>kokko        | okko              |
| Who?       | bhesú                | bhesú               | gadéimá                | haná                          | airau            | siné            | sekó                        | seto              |
| Any thing  | bhemlya              | bhámhya             | ....                   | ....                          | ....             | ....            | anjoko                      | okko              |
| Any body   | bhesúmhya            | bhesúmhya           | ....                   | ....                          | ....             | ....            | ....                        | sekodi            |
| Eat        | chá                  | sá                  | sháu                   | cháo                          | chióng           | tyu             | dol anka                    | dolangka          |
| Drink      | sok                  | eik                 | luu                    | joko                          | chajamti         | thun            | taipú                       | túpu              |
| Sleep      | ip                   | re                  | yápu                   | jápo                          | annanú           | annú            | iddo                        | yün               |
| Wake       | só                   | re                  | dúmu                   | ngó                           | ula              | phayá           | emú aipú                    | dárdoku           |
| Laugh      | re                   | ye                  | manú                   | sapo                          | mannú            | mannú           | nilodopú                    | yínda             |
| Weep       | ngó                  | ngó                 | khápu                  | ....                          | échaprr          | chappale        | kappú                       | kappa             |
| Be silent  | titchhit né          | teikaheik né        | temdingau              | thóo                          | manakazong       | ayok sulang     | ásopú                       | ásopa             |
| Speak      | pro, chíhó           | pyo, a'hó           | sáu                    | káro                          | shang            | suang           | lúpú                        | saluto            |
| Come       | lá, rok              | lé, yauk            | sáu                    | káo                           | arung            | ahali           | gikúpú                      | kápú              |
| Go         | swá, kwyá            | tháwé, kyúá         | wán                    | ....                          | tsu, wang        | chennang        | gupú gikangká               | sá                |
| Stand up   | tha, mat             | thé, mát            | tsapu }                | chapo                         | nótak            | septak          | dangtúpú                    | dárup             |
| Sit down   | thaing               | thaing              | rotu }                 | tóngu                         | manákár          | mannang         | dúpú                        | dutoka            |
| Move, walk | le, kwyá             | le, kyúá            | dúngu                  | chóo, khuams                  | asámataur        | asambat         | íokoda                      | gúmaudak          |
| Run        | pré                  | pyé                 | thotú, damu            | chuano                        | sámawung         | ásambat         | dukupú                      | dupandak          |
| Give       | péhya                | pé khyá             | yáu                    | kóo                           | kwáng            | khalang         | bípú                        | sopá              |
| Take       | yú                   | yá                  | láu                    | kapo                          | niagir           | chiokko }       | lápú                        | lato              |
| Strike     | raik, put            | yauk, pót           | dúpu                   | váto                          | tataung }        | anno }          | pápú                        | duto              |

| English.   | Burman,<br>Written. | Burman,<br>Spoken. | Bronson's<br>Singpho. | Bronson's<br>Namtsang<br>Naga. | Nwongong<br>Naga. | Tengsa<br>Naga. | Capt. Smith's<br>Abor-Miri. | Sibesar<br>Miri. |
|------------|---------------------|--------------------|-----------------------|--------------------------------|-------------------|-----------------|-----------------------------|------------------|
| Kill       | sat                 | thát               | satu                  | rikráto                        | ásoko             | ásoko }         | pápu                        | dingteto         |
| Bring      | yáthe               | yéthe              | láu                   | vanro                          | ányauug           | styang }        | bompipu                     | bomkuka          |
| Take away  | yáwá                | yáAwá              | láu wáu               | kaptáto                        | penruang          | cheba chenang } | bomkang                     | bomkang          |
| Lift up    | mhrang,<br>mhrok    | mhyen,<br>mhyauk } | phóun                 | tuons                          | schóngatóng       | aiyóang         | kásápu                      | jowon            |
| Hear       | krá                 | krá                | nángu                 | táto                           | ásáhu             | ángang          | tadkapú                     | táttoka          |
| Understand | lin, si             | le, thi            | ehóiu                 | sjáto                          | matúrmá           | nyangmanang     | ken                         | hintoka          |
| Tell       | chhó, krá           | s'ho kyá           | sáp                   | ngáo                           | shiang            | suang           | lópú                        | lubda            |
| Good       | kong                | kaung              | gujá                  | asan                           | tatóng            | chóngkolo       | aidu                        | aida             |
| Bad        | chhó                | s'bo               | nguiá                 | schí                           | matbóng           | machóng         | aimang                      | aima             |
| Cold       | khyam, é            | khyán, é           | kataí                 | aki                            | kásatúá           | áchkale         | anango                      | ansinge          |
| Hot        | pú                  | pú                 | káthet                | akhám                          | tatsook           | lamme           | gudórong                    | alkire           |
| Raw        | chim                | seing              | ketsing               | áhing                          | máioók }          | tái             | ....                        | gunáme           |
| Ripe       | mhis, rang          | mhe, yen           | min                   | áchám                          | tazru             | táman           | mindó                       | leda             |
| Sweet      | khyó                | khyó               | dái                   | átú                            | táman             | tánang          | tídó                        | minda            |
| Sour       | khyis               | khyin              | khri                  | ásí                            | téan              | seelia          | kune                        | tídák            |
| Bitter     | khá                 | khá                | khá                   | akhé                           | pakiá             | pakiá           | kodák                       | kudák            |
| Handsome   | lha                 | lhé                | játoí                 | asamá                          | kángatóng         | chongthang      | kampodó                     | kángkáne         |
| Ugly       | arup chhó           | ayóthó             | samnáng               | pangtái                        | matóng            | machóng         | punda                       | almang           |
| Straight   | phong               | phý sung           | preng                 | átíng                          | tumatum           | matongkolo      | muwat, gadó                 | guyokdák         |
| Crooked    | kók                 | kauk               | mágo                  | akuang                         | thrak             | kóikolo         | yákar                       | gudák            |
| Black      | nak                 | net                | cháng                 | anyak                          | tanak             | nyakia          | asidó                       | yákádák          |
| White      | phrá                | phýú               | phróng                | apó                            | tamasóng          | masang          | yaling                      | kámpodák         |
| Red        | ni                  | phýú               | khýeng                | achak                          | maram             | malamia         | ....                        | lhák             |
| Green      | chim                | seing              | ketsing               | ahing                          | tacham            | tacham          | beddoló                     | gedák            |
| Long       | rhin                | shé                | gáú                   | álo                            | talang            | lángkolo        | adedi                       | siárdák          |
| Short      | tó                  | tó                 | kután                 | átóon                          | talángka          | ánanglá         | ....                        | ándudák          |
| Tall       | mhang               | myen               | taode                 | schueng                        | ....              | lánglá          | ....                        | siárdák          |

| English.  | Burman,<br>Written. | Burman,<br>Spoken. | Bronson's<br>Singpho. | Bronson's<br>Namesang<br>Naga. | Nowong<br>Naga. | Tngsa<br>Naga. | Capt. Smith's<br>Aboor-Miri. | Sibagor<br>Miri. |
|-----------|---------------------|--------------------|-----------------------|--------------------------------|-----------------|----------------|------------------------------|------------------|
| Short     | nim                 | neing              | katún                 | amlenpa                        | tatú            | áanglá         | adedi                        | ándádák          |
| Small     | nge                 | nge                | katsí                 | áring                          | tilala          | tesu           | angidó                       | ámedák           |
| Great     | kri                 | kýi                | gabá                  | adóng                          | talula          | tapó           | bóte                         | átadák           |
| Round     | jun                 | lóng               | dindin                | átúm                           | tarang          | litúpa         | ....                         | átumdák          |
| Square    | lèthong             | lédhaung           | ....                  | ....                           | tangakáku       | tangik         | ....                         | ....             |
| Flat      | pyá                 | pyá                | ram                   | tode                           | matam           | madamka        | neing sudó                   | omandák          |
| Fat       | wá, tup             | wá, tók            | phám                  | atat                           | tabók           | tabók          | udó                          | juiname          |
| Thin      | lhyá                | shyá               | lasi                  | achá                           | apoprr          | apo            | ....                         | gidák            |
| Weariness | mo, pangban         | mo, penbán         | báhá                  | bón                            | ányokó          | ngúebaho       | ....                         | amíase           |
| Thirst    | ré ngat             | ye ngát            | pháng gerá            | khamlán                        | { tukula        | chebalé }      | tuling                       | molámak          |
| Hunger    | chá ngat            | shángát            | kosá                  | ramrí                          | { serattár      | chulale }      | kinong                       | tuling           |
|           |                     |                    |                       |                                | yatár           | chulale        |                              | konóng           |

"In Burman I have used *th* to express the sound of *th* in *think*. I have also put in italics the initial letter of a syllable to denote the falling tone—and a dot under the final vowel to denote the short, abrupt tone. The Singpho and Namesang Naga are taken from a vocabulary published several years ago by the Rev. Mr. Bronson, and may be depended on as correct. The other two Naga dialects are given by two men from villages near Nowgong—the only Nagas I can find in the station just now; and as they do not understand Asamese very well, I may have introduced some errors from them. At all events the words are evidently encumbered with affixes and prefixes that do not properly belong here; I have not however ventured to remove any of them, as you will be better able to do this. I am inclined to think that the radical forms in all these languages are monosyllabic, as the Burmese unquestionably is. The verbs, &c. would probably show a much greater resemblance if we had all the terms for each idea; as there will generally be many verbs, nearly synonymous, consequently the lists do not always exhibit the corresponding forms—thus creating an apparent difference where there is none in reality."

*On preparing Fac-similes of Coins, &c.—By J. W. LAIDLAY, Esq.*

Convenient, expeditious, and easy methods of making fac-similes of coins, gems and inscriptions have ever been objects of importance to the antiquarian and the traveller; and as several of my correspondents have found those which I am about to describe, and which I have practised for some time past, to possess all these advantages, it may not be amiss to devote a short space in the Journal to make them more generally known.

To prepare fac-similes of coins and medals, the operator should have in readiness a few balls of yellow bees'-wax, and a little plumbago in fine powder. The former may vary in size from that of a small pistol bullet upwards, according to the size of the medal to be copied, and may be kept in readiness for use in a wide-mouthed phial. One of these waxen balls having been selected, is to be flattened by pressure upon a small disc of wood or copper (an old smoothworn pyce answers extremely well), which serves as a support for it, and prevents its subsequent alteration of form by keeping. The wax thus flattened and extended to about the size of the medal to be copied, is to be rubbed on its surface with a little of the powdered plumbago applied by means of the finger. It will immediately assume a high metallic polish, and is then ready to receive the impress of the coin. This is effected by simply laying the latter upon the wax, and pressing it into the polished surface, either with the thumb, or by means of a large pair of pincers, or by any other process ensuring a uniform steady pressure. When the impress is considered perfect, the coin is easily detached by a slight tap, there being seldom any disposition to adhere, if sufficient plumbago be employed, and more especially if the coin be breathed upon, or moistened, before the operation.

On removing the coin, the wax will be found to have received a beautiful and delicately perfect impression by a process mechanically analagous to that by which the original itself was formed. This process will be found greatly superior to those given in books, such as that by means of sealing wax, or plaster of Paris, or melted stearine. The first is generally deficient in sharpness; the last often causes vexation by the adhesion of the medal, or the formation of bubbles on

its surface; while none of them is so expeditious as the one I now describe, by means of which fac-similes of an extensive cabinet of medals may be obtained in a few hours.

The waxen matrices thus prepared may, with proper precaution, be kept an indefinite time, or transmitted to any distance for the final process, that is, the revival of the medal by electrotype deposit. When this is to be done, a little more powdered plumbago should be brushed to and fro upon the mould with a rather stiff painting brush, and then well cleaned away. This serves to restore the continuity of the conducting surface where it may be broken by the impression; a circumstance very likely to occur where the legend is in high relief. A hot wire being now passed round the edge of the matrix to destroy the electric connection with the metallic support, renders the mould fit for placing in the depositing trough, where the process is completed in the usual way.

I had the honor to submit to the Society specimens of electrotype fac-similes prepared in this manner about two years ago. It is obvious however that this process is applicable to many other objects and purposes besides the copying of coins. Wood-cuts and other engravings in relief may be multiplied in the same manner; and even stereotype plates of letter-press may be similarly prepared with the utmost facility. All that is requisite is to expose a prepared surface of wax laid upon the type-forms to gentle pressure, and submit the impression thus obtained to the action of the electrotype. I have the honor to lay before the Society a specimen of this mode of stereotyping, being a page from the *Veda*, prepared by the indulgent permission of the Rev. J. Thomas of the *Baptist Mission Press*. This first attempt, made now more than a year ago, sufficiently testifies the ready practicability of the process. I had occasion about the same time, in reply to some questions from my esteemed correspondent, the Rev. Dr. Gutzlaff of Hong Kong, regarding the application of stereotype to Chinese printing, to recommend this process to his consideration as one eminently adapted to the special case of copying wooden blocks. I have not yet heard the result of his experiments, but have no doubt of their eventual success.

It now only remains to describe the method of taking paper fac-similes of inscriptions. The ordinary mode of doing this by inking the surface, either with common or printing ink, has the disadvantage

of giving a reversed copy of the original, and has other, and those considerable, inconveniences which are troublesome enough in practice. My friend Capt. Kittoe, who has had more experience in this department of practical archæology than falls to the lot of many, improved the process greatly by overlaying the sheet of paper upon which the impression is to be taken with another prepared with a proper pigment, and then applying the requisite pressure or friction; precisely as is done in copying by what is called "carbonic paper." This had the advantage of giving the impression erect: but the following is much simpler, more expeditious and more cleanly;—Lay the paper upon the inscribed surface and rub it with a large cork primed with powdered plumbago; wherever the surface resists, the plumbago adheres and may be fixed by freely rubbing in. The excised parts receive no impression. The fac-simile thus prepared may be afterwards improved if necessary by pen and ink. The process, however, is capable of such delicacy and exactness, that with fine paper, it may be used to copy in fac-simile the slightly depressed lettering on the back of a book. The powdered plumbago may be kept for the purpose in a wide mouthed phial, the cork of which will always be ready for use.

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PROCEEDINGS  
OF THE  
ASIATIC SOCIETY OF BENGAL

FOR AUGUST, 1849.

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The ordinary meeting of the Asiatic Society held on Wednesday, the 5th of September, 1849.

Dr. J. McCLELLAND, Senior Member present, in the chair.

The proceedings of the last meeting were read and confirmed, and the accounts and vouchers of the preceding month were laid upon the table as usual.

*Raja Pratapa Chandra Singha, Babu Rajendra Dutt* and *Captain E. Fytche*, having been proposed and seconded at the August meeting, were ballotted for and elected ordinary members of the Society.

Read letters—

From Sir H. M. Elliot, K. C. B. Secretary to the Government of India with the Governor General, forwarding “Diary of a Trip to Pind Dadm Khan and the Salt Range,” by Mr. Assistant Surgeon A. Fleming.

From H. Cumming, acknowledging the receipt of a bill of exchange for £25-10-0, and soliciting the attention of the Secretary to a promise made by him for transmitting to Mr. C. a selection of duplicate shells in return for those already received by the Society in 1843.

From Lieut. R. C. Wroughton, expressing, on behalf of himself and other surviving relatives of Brigadier Stacy, their heartfelt thanks for the sympathy of the Society on the occasion of the death of that eminent antiquarian, as conveyed in their resolution of September, 1848.

From Col. J. Low, forwarding the original stone containing the facsimile of an inscription published in the Journal of the Asiatic Society for July, 1849.

John Barlow, Esq., Secretary to the Royal Institution of Great Britain, conveying the thanks of the Institution for a copy of the Asiatic Society's Journal, No. 199.

From Major W. Anderson, a paper on the "Routes and Stages in the North Western provinces of India in 1750."

From the same, "Sketch of the recorded revenues of the states beyond the Sutlej, about 1750 to 1800."

From H. Piddington, Esq. Charts of his 17th and 18th Memoirs of the Law of Storms in India.

Read extract of a letter from Lieut. R. C. Wroughton, intimating his desire, with reference to a para. in Brigadier Stacey's will, to dispose of, if there be any, the stones, sculptures and old copper-plate gift of land belonging to Brigadier Stacy in the Society's Museum.

Read extract of a letter

From Mr. Gutzlaff, returning his thanks to the Society for the Tibetan books presented to him.

The Report of the Council upon the Financial condition of the Society, having been in pursuance of the resolution of the preceding meeting, brought forward for consideration, after some discussion, the following resolution was proposed by Mr. Newmarch, seconded by Mr. Heatly, and carried,

"That the Financial Report of the Council be adopted with the following modifications, that is to say, that the allowance hitherto made to Mr. Blyth of 40 Rs. per month in respect of house rent be continued, and that the Librarian's salary be continued at 100 Rs. per month instead of 50 Rs. per month, as proposed by the Council; also that in the Zoological department one assistant be retained on 20 Rs. per month, one taxidermist on 30 Rs. per month, and one other taxidermist on 15 Rs. per month, instead of the establishment proposed by the Council of 2 taxidermists each at 30 Rs. per month; and that 2 Durwans be retained instead of one only, as proposed by the Council.

J. W. COLVILLE.

*Read and confirmed, Dec. 8th, 1849.*

J. W. LAIDLAY.

*Erratum in the last number,—page 858.*

For "Dr. J. M'LELLAND in the chair," read "The Hon. the PRESIDENT in the chair."

## CATALOGUE OF MALAYAN FISHES.

By THEODORE CANTOR, *Esq. M. D. Bengal Medical Service.*

[Localities printed in *Italics* signify those from whence the fishes were obtained ; in ordinary type those previously given by authors. The descriptions are drawn up from recently taken specimens.]

### SUBCLASSIS—TELEOSTEI.

#### ORDO.—ACANTHOPTERI.

##### FAM. PERCOIDÆ.

GEN. LATES, *Cuvier and Valenciennes*, 1828.

Infraorbital- and humeral bones, and preopercle strongly toothed, the latter with a spine at the angle ; anterior dorsal fin higher but shorter than in *Perca* and *Labrax* ; tongue smooth.

#### LATES HEPTADACTYLUS, (Lacépède.)

*Perca maxima*, Sonnerat (MS. ?) Cuv. and Val. II. 96.

*Holocentre heptadactyle*, Lacépède, IV. 344 and 391.

Russell, CXXXI. Pandoomenoo.

*Coius vacti*, Buchanan Ham. 86, 369, Pl. 16, Fig. 28.

*Lates nobilis*, Cuv. and Val. II. 96, Pl. 13.

*Lates nobilis*, Cuv. R. A. II. 134<sup>(1)</sup>.

*Lates nobilis*, Richardson : Report, 1845, 222.

*Lates nobilis*, Bleeker : Verh. Batav. Genoots. XXII. 16, 27.

Ikan Siyakup of the Malays.

Head and back brownish, or blackish pale green, sides silvery grey ; scales with a brownish spot at the root, or edged with that colour ;

No. XXXIV.—NEW SERIES.

abdomen silvery; pectorals and ventrals pale yellow, the other fins brownish or blackish. Iris blackish golden; pupil cornelian red.

\*D 7 or 8—1/11 or 12, C 18 or 17½, A 3/8 or 9, V 1/5, P. 17 or 18.  
Br. VII.

HABIT.—*Sea and estuaries of Pinang, Malayan Peninsula, Singapore.*

Bay of Bengal, estuaries of the Ganges, Indian Ocean, China Sea, Canton, Java, Madura.

TOTAL LENGTH, 5 feet.

Those inhabiting brackish water are of a muddy flavour, and blackish or of much darker colours than those living in the sea. The species appears to be less numerous in the Straits of Malacca than in Bengal. Both in fresh and in dried state, it is highly valued as an article of food. It also yields isinglass, of which however, in the Straits, but little is collected, partly on account of the comparative scarcity of the fish, and partly owing to the thinness of the air-vessel. That of a large-sized fish when dried, weighs upwards of one ounce. At Pinang this kind sells at the rate of 25 to 30 Spanish Dollars pr. Pikul.

GEN. APOGON, *Lacépède*, 1802.

Scales large, deciduous; the two short dorsals widely separated; margin of the preopercle double, finely toothed; pyloric appendages few.

APOGON PÆCILOPTERUS, Kuhl. and Van Hasselt?

? Apogon pæcilopterus, Cuv. and Val. II. 154

Head above, back and upper half of the sides reddish brown; lower half and abdomen mother of pearl; crown and sides of the head minutely dotted with black; opercles silvery; on the tail, in the middle of the base of the caudal, a large rounded blackish spot; membrane between first, second and third spines black; rest hyaline, minutely dotted with brown; posterior dorsal, caudal and anal, pale yellowish, dotted with pale brown, ventrals pale yellowish; pectorals hyaline. Iris mother of pearl, upper half black.

D 6—1/9, C 15½, A 2/8, V 1/5, P 13, Br. VII.

\* Russell: D 7—1/13, C 18, A 3/9, V 1/5, P 15.

Buchan: D 7—1/12, C 18, A 3/11, V 1/5, P 17.

Cuv. and Val: D 7 or 8—1/12, A 3/8 or 9.

HABIT.—*Sea of Pinang, Singapore.*

TOTAL LENGTH,  $4\frac{1}{2}$  inch.

The length of the head is  $\frac{1}{3}$  of the total; the orbit borders on the profile, and occupies the second fourth of the head; the distance between the orbits across the forehead is  $\frac{2}{3}$  of the horizontal diameter of the orbit, which is  $\frac{1}{3}$  of the length of the head. The posterior margin of the preopercle is finely serrated nearly all round, except a small portion of the lower part; the opercle terminates in a broad triangular membranous point, in the upper margin of which appears a deep rounded incision. The vertical diameter at occiput is  $\frac{2}{3}$ , in front of the anterior dorsal a little less than the length of the head, at the root of the caudal it slightly exceeds  $\frac{1}{3}$  of the head. The sides are covered by 11 longitudinal series of rounded, finely ciliated scales, each with 15 to 18 radiating lines at the base. The lateral line follows the outline of the back; it occupies the third upper series of scales, 23 or 24, on each of which appears a central, longitudinal tube, with one or two minute tubes on each side of its root. The scales of the series immediately above and below the lateral line present an indistinct longitudinal elevation. The first dorsal spine is  $\frac{1}{3}$  of the second and third, the longest and strongest, each of which is  $2\frac{1}{3}$  of the length of the head; the sixth spine exceeds the first by one third; the spine of the posterior dorsal, the second anal and the ventrals are of equal length,  $\frac{1}{3}$  of that of the head. In the inconstant character of colours, the present species differs from *A. pœcilopterus*, but both agree in their number of fin rays, and general resemblance to the Mediterranean species. (*A. rex mullorum*, Cuv. and Val. II. 143.) It is to be regretted that the description of *A. pœcilopterus* is not sufficiently explicit for identification. At Pinang and Singapore single individuals of the present species are of uncertain occurrence.

APOGON QUADRIFASCIATUS, Cuv. and Val.

? *Mullus fasciatus*, White; Voyage, 268, Fig. 1

*Apogon quadrifasciatus*, Cuv. and Val. II. 153.

*Apogon quadrifasciatus*, Bleeker: Verh. Batav. Gen. XXII. 16, 28.

Crown of the head and back brownish black; sides and abdomen, mother of pearl; a broad black band from above the orbit to the root of the caudal; a second parallel from behind the orbit, first beneath the lateral line, but from near the posterior part of the second dorsal

it intersects the lateral line, continuing above it through the middle of the caudal fin; upper half of anterior dorsal, between 3d and 6th spine, more or less intense black; the other fins pale yellowish, or pale crimson; all except the pectorals with broad blackish margins. Iris silvery with large black spots.

D 7—1/9, C 17½, A 2/8, V 1/5, P 16, Br. VII.

HABIT.—*Sea of Pinang, Singapore.*

Pondicherry, Batavia.

TOTAL LENGTH, 4½ inch.

In the young the two lateral black bands, and the blackish margins of the fins are very indistinct, or scarcely perceptible. All the species of the fins exhibit traces of transversal striæ. This species is not numerous at Pinang.

#### APOGON FUCATUS, Cantor.

Body and fins, except the pectorals, silvery carmine with rainbow reflections, cheeks, throat and abdomen paler; from the lower part of the orbit to the muzzle a gamboge oblique line; at the root of the caudal a large round black spot, surrounded by numerous minute brown dots, and a few similar on the scales of the posterior part of abdomen. Pupil circular, black with crimson reflection; iris golden gamboge, the upper fourth part ultramarine.

D 6—1/9, C 18½, A 2/16, V 1/5, P 13, Br. VII.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH, 2½ inch.

The length of the head is contained about 3½ times in the total; its depth, which is little less than that of the body, equals its length; the eye is large, circular, the diameter slightly exceeding ½ of the length of the head; the mouth small, little protractile; gape subvertical; the angle of the mouth a little in front of the anterior margin of the orbit; teeth excessively minute; margin of preopercle very finely toothed; lateral line following the outline of the back, nearly throughout oblique, becoming horizontal close to the root of the caudal. Examined under a lens, the spines of all the fins are transversely striated, as in the Genus *Chanda*. The spines of the anterior dorsal are very slender, as in *A. macropterus*, Kuhl and Van Hasselt, and scarcely arched. The lower part of the anterior margin of the second spine is armed with three blunt teeth, vertically situated. The second, third and fourth spine,

WIND VELOCITY MEASURED BY ANEMOMETER.

WIND VELOCITY MEASURED BY ANEMOMETER.

WIND VELOCITY MEASURED BY ANEMOMETER.

| Date. | Bar. P.<br>32° F. rel. to | Temperature. |         | Wind.    | Aspect of Sky. |               | Bar. P.<br>32° F. rel. to | Temperature. |         | Wind.    | Aspect of Sky. |               | Bar. P.<br>32° F. rel. to | Temperature. |         | Wind.    | Aspect of Sky. |               |
|-------|---------------------------|--------------|---------|----------|----------------|---------------|---------------------------|--------------|---------|----------|----------------|---------------|---------------------------|--------------|---------|----------|----------------|---------------|
|       |                           | Of Mer.      | Of Air. | W. Bulb. |                |               |                           | Of Mer.      | Of Air. | W. Bulb. |                |               |                           | Of Mer.      | Of Air. | W. Bulb. |                |               |
| 1     | Inches<br>29.540          | 80.4         | 81.2    | 80.0     | E.             | Zenith clear  | 29.501                    | 80.0         | 89.0    | 88.5     | E. S. E.       | Cumulo strati | Inches<br>29.562          | 92.7         | 90.5    | 89.0     | E.             | Nimbi         |
| 2     | .596                      | 80.3         | 81.0    | 80.0     | E. N. E.       | Cloudy        | .642                      | 89.7         | 88.8    | 82.3     | E. S. E.       | Ditto         | .617                      | 92.1         | 90.8    | 83.3     | E. N. E.       | Cumulo strati |
| 3     |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| 4     | .670                      | 79.8         | 80.7    | 79.4     | E.             | Cirro strati  | .717                      | 89.9         | 87.7    | 81.8     | S. S. E.       | Cumulo strati |                           | 88.9         | 87.6    | 80.8     | S.             | Ditto         |
| 5     | .665                      | 79.7         | 80.5    | 79.0     | E.             | Ditto         | .697                      | 89.8         | 88.8    | 82.0     | S. S. E.       | Ditto         |                           | 88.9         | 87.6    | 80.8     | S.             | Ditto         |
| 6     | .672                      | 80.7         | 81.5    | 80.3     | S. W.          | Ditto         | .739                      | 90.2         | 88.0    | 80.9     | S. S. E.       | Ditto         |                           | 92.9         | 90.1    | 82.6     | S. E.          | Ditto         |
| 7     | .743                      | 80.3         | 81.0    | 79.3     | S. E.          | Cumuli        | .801                      | 89.2         | 87.6    | 81.2     | S. E.          | Ditto         |                           | 90.6         | 87.8    | 81.0     | S. S. E.       | Ditto         |
| 8     | .777                      | 79.9         | 80.4    | 79.0     | E. N. E.       | Cirro strati  | .797                      | 87.1         | 85.8    | 81.0     | S. E.          | Ditto         |                           | 90.6         | 87.8    | 81.0     | S. S. E.       | Nimbi         |
| 9     | .708                      | 79.2         | 80.0    | 79.0     | E.             | Cloudy        | .794                      | 87.2         | 85.0    | 80.8     | S. E.          | Drizzly       |                           | 90.8         | 81.0    | 78.0     | N. E.          | Cloudy        |
| 10    | .655                      | 79.7         | 80.2    | 78.9     | E.             | Cirro cumuli  | .687                      | 87.8         | 87.2    | 81.3     | E.             | Cumulo strati |                           | 90.8         | 88.9    | 81.3     | E.             | Cumulo strati |
| 11    | .691                      | 79.2         | 80.0    | 78.8     | S. S. E.       | Cirro strati  | .748                      | 89.4         | 86.8    | 80.8     | E.             | Ditto         |                           | 90.4         | 90.0    | 83.5     | N. N. E.       | Ditto         |
| 12    | .721                      | 79.3         | 80.0    | 79.0     | S. E.          | Ditto         | .752                      | 87.8         | 86.3    | 80.7     | E.             | Ditto         |                           | 91.1         | 88.2    | 83.2     | S. S. E.       | Rainy         |
| 13    | .649                      | 79.7         | 80.0    | 79.0     | S. E.          | Clear         | .685                      | 89.8         | 86.7    | 80.9     | S. E.          | Ditto         |                           | 96.0         | 83.8    | 80.6     | S. S. E.       | Drizzly       |
| 14    | .818                      | 80.0         | 80.8    | 79.7     | N. E.          | Cirro cumuli  | .655                      | 88.7         | 86.4    | 80.5     | N. E.          | Ditto         |                           | 91.2         | 90.4    | 82.1     | E.             | Cumulo strati |
| 15    | .810                      | 80.1         | 80.8    | 79.2     | N. E.          | Ditto         | .640                      | 89.3         | 88.0    | 80.4     | E.             | Cumuli        |                           | 92.0         | 90.9    | 81.8     | E.             | Cumuli        |
| 16    | .636                      | 80.4         | 81.3    | 79.4     | E. N. E.       | Cumuli        | .666                      | 89.0         | 88.0    | 80.3     | E.             | Cumulo strati |                           | 89.4         | 84.7    | 79.4     | S.             | Cloudy        |
| 17    | .696                      | 80.2         | 80.9    | 79.5     | E.             | Cumulo strati | .757                      | 85.0         | 84.3    | 80.4     | E.             | Ditto         |                           | 84.9         | 79.9    | 78.3     | E.             | Rain—Thund.   |
| 18    | .710                      | 78.5         | 79.2    | 78.5     | S. E.          | Cirro strati  | .736                      | 88.9         | 87.5    | 84.9     | S.             | Ditto         |                           | 91.0         | 89.2    | 82.9     | S. W.          | Cumulo strati |
| 19    | .698                      | 79.8         | 80.5    | 79.5     | S. E.          | Ditto         | .669                      | 89.6         | 89.0    | 82.3     | N. E.          | Ditto         |                           | 92.3         | 91.3    | 82.0     | N. E.          | Ditto         |
| 20    | .604                      | 81.0         | 81.9    | 80.5     | S.             | Ditto         | .655                      | 91.2         | 89.3    | 81.3     | E.             | Ditto         |                           | 93.2         | 91.0    | 82.2     | E. N. E.       | Ditto         |
| 21    |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| 22    |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| 23    |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| 24    |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| 25    |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| 26    |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| 27    |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| 28    |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| 29    |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| 30    |                           |              |         |          |                |               |                           |              |         |          |                |               |                           |              |         |          |                |               |
| Mean  | 29.662                    | 79.9         | 80.6    | 79.4     | ...            | ...           | 29.704                    | 89.0         | 87.3    | 81.3     | ...            | ...           | 29.666                    | 90.2         | 88.2    | 81.4     | ...            | ...           |

[illegible]



are of nearly equal length : about one half of the vertical diameter of the body. The spine of the posterior dorsal fin equals in length the longest anterior, but the second branched ray, which slightly exceeds the first and third, is  $\frac{2}{3}$  of the vertical diameter of the body. The distance between the last, double, ray of the posterior dorsal, and the root of the caudal equals the length of the head. The caudal is slightly forked : the length of the centre  $\frac{1}{2}$  of the total. The basal extent of the anal is a little less than the length of the head ; the second and third branched ray are the longest, equalling the corresponding rays of the posterior dorsal fin. - The distance between the sixteenth double anal ray, and the root of the caudal is but about one half of that between the latter and the last ray of the posterior dorsal, or about  $\frac{1}{2}$  of the length of the head. The first branched ray of the ventrals equals in length the second spine of the anterior dorsal. The length of the transparent pectorals is about  $\frac{1}{2}$  of the vertical diameter of the body.

This species is closely allied to *Apogon lineolatus*, Ehrenberg, the peculiar colouration is strikingly similar in both, but it differs from the latter, and the other species, in the greater number of anal rays, and in the toothed appearance of the second dorsal spine. A single specimen was observed at Pinang in July 1845. The fishermen asserted it to be of very rare occurrence. The very capacious stomach, occupying the whole length of the abdominal cavity, was expanded with minute shrimps ; the intestinal canal is less than one third of the total length, and without cœcopyloric appendages. The rounded acoustic bones are, for the size of the fish, remarkably large.

GEN. CHANDA,\* *Buchan. Ham.* 1822.

(*Ambassis*,† *Cuv. and Val.* 1828.—*Hamiltonia*,‡ *Swainson*, 1839.)

\* Not from *चण्ड*, *hians*, as stated by mistake in *Nomenclator Zoologicus*, (*Pisces*, p. 15,) but from *Chanda*, the vernacular name, applied in Bengal to the Genus. (*Chandee*, Hind. Silver.)

† MM. Cuvier and Valenciennes observe that the two first species of *Chanda*, described by Buchanan, belong to a different genus, and they have for that reason cancelled *Chanda*. Buchanan himself expressed doubts as to the propriety of placing his first species in that genus.

‡ *Fam. Zenida (Scombroidea, Bonap.) Swainson, Fishes, &c. Vol. II. p. 250.* “ *Hamiltonia ovata*, Sw., *Ham. fig. 37*, and *H. lata*, Sw., *Ham. fig. 37*.” Both references are errata.

Teeth sharp, scattered in both jaws, with some of the bones of the head distinctly indented on the edge; with prickles in some of the fins, and with bodies more or less diaphanous, and much compressed; the sides nearly perpendicular.

CHANDA DUSSUMIERI, (Cuv. and Val.)

Ambassis dussumieri, Cuv. and Val. II. 181.

Ambassis dussumieri, Bleeker: Verh. Bat. Gen. XXII. 17, 30.

Crown of the head and the back pale greenish, minutely dotted with black, opercle bluish silvery; sides pale silvery with a narrow longitudinal shining silvery band from the opercle to the caudal fin; abdomen transparent with the silvery peritoneum shining through. Fin-membranes transparent; that connecting the 2d and 3d dorsal spine, minutely dotted with black and with a black margin; caudal in some with a blackish margin. Iris silvery; the upper fourth part black.

D 7—1/9, C 17½, A 3/9, V 1/5, P 17, Br. VI.

HABIT.—*Sea of Pinang.*

Malabar, Java, Madura.

TOTAL LENGTH: 3 inch.

The vertical diameter of the body is contained about 3½ times in the total length. This species appears to occur but rarely at Pinang. In three examined there was no external appearance of the horizontal spine in front of the first dorsal.

CHANDA NALUA, Buchan. Ham.

Chanda nalua, Buch. Ham. 107, Pl. 6, Fig. 36.

Ambassis nalua, Cuv. and Val. II. 182.

Ambassis nalua, Bleeker: Verh. Bat. Gen. XXII. 17, 29.

Crown of the head and back pale greenish, with a few indistinct blackish spots at the base of the dorsal fins; sides pale silvery, with a narrow longitudinal shining silvery band from the opercle to the caudal fin; cheeks and opercles iridescent silvery, the latter with a blackish spot between the angle and the orbit, produced by numerous blackish dots; abdomen transparent, iridescent, with the silvery peritoneum shining through; fins pale citrine, the membrane of the anterior dorsal minutely dotted with black, particularly between the 2d and 3d spine, with a black margin. Iris silvery with a black spot beneath the upper margin of the orbit; pupil circular, black with crimson reflection.

D 7—1/9, 10 or 11, C 17½, A 3/9 or 10, V 1/5, P 15, Br. VI.

HABIT.—*Sea of Pinang.*

Rivers of Lower Bengal, Batavia, Samarang, Surubaya, Bima, Sumbawa.

TOTAL LENGTH : 4½ inch.

As observed by MM. Cuvier and Valenciennes this species differs from *Chanda gymnocephala* (Lacépède). (Syn. *Sciæna safga* Forskal?—*Lutjanus gymnocephalus*, Lacép.—*Centropomus ambassis*, Lacép.—*Ambassis commersonii*, Cuv. and Val. II. 17, Pl. 25) by its comparatively shorter head, blunter muzzle, and greater depth of the body. Besides, it may at once be distinguished by the extent of the membrane connecting the anterior to the posterior dorsal, which in the present species attaches itself to the lower third of the spine of the posterior dorsal, but does not as in *Chanda gymnocephala* descend nearly down to the level of the back. From the individuals described by Buchanan, those inhabiting the sea differ slightly in colours, and in having one, rarely two, branched rays less in the posterior dorsal and anal fins. The species is at all seasons of no rare occurrence at Pinang. It feeds on small *Crustacea*.

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The preceding species of *Apogon* and *Chanda* are of little value as articles of food. At Pinang they, as well as numerous other small fishes, the daily residue of the market, are used as manure.

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GEN. *SERRANUS*, Cuv. and Val. 1828.

Dorsal fin single; preopercle serrated; opercle with two or three flat spines; teeth velvety, with a greater or smaller number of longer, pointed teeth; crown of the head, opercles, and cheeks covered with scales; muzzle and jaws with more or less perceptible scales, or apparently naked.

*SERRANUS HEXAGONATUS*, (Forster.)

*Percæ hexagonata*, Forster.

*Holocentrus hexagonatus*, Bloch. Schneider.

*Serranus hexagonatus*, Cuv. and Val. II. 330.

*Serranus stellans*, Richardson, Ann. Nat. Hist. March 1842.

*Serranus hexagonatus*, Richardson: Voy. Sulph. 82, Pl. 38, Fig. 1.

Ground colour of the head above, back and upper half of the sides pale reddish brown with numerous rounded, frequently confluent spots,

all indistinct and of a shade but slightly darker than the ground colour ; lower half of the sides diluted reddish brown, becoming whitish on the abdomen ; fins reddish brown, darker than the body from their numerous indistinct spots, the largest of which along the back between the dorsal spines ; upper margin of the dorsal membrane black ; all the spines greyish brown. Iris reddish brown, with a narrow golden ring.

D 11/17, C 17- $\frac{3}{4}$ , A 3/8, V 1/5, P. 17, Br. VII.

HABIT.—*Sea of Pinang.*

Isles of Borabora and Oualan, South Pacific.

TOTAL LENGTH : 7 $\frac{3}{4}$  inch.

The length of the head is  $3\frac{1}{2}$  of the total ; the vertical diameter at occiput is  $\frac{3}{4}$  of the length of the head ; the greatest oblique diameter of the orbit is about  $4\frac{1}{2}$  of the length of the head ; the margin of the preopercle is rounded, the ascending part strongly toothed, the three lowest teeth larger than the rest ; of the three spines of the opercle the upper one is the smallest, and the centre one the largest, its length equalling  $\frac{1}{2}$  of the diameter of the eye ; the membranous portion of the opercle is elongated to a sharp point. The upper maxillary teeth are preceded on each side by a single curved canine, inside of which appear several pointed teeth, conspicuously longer than all the rest. The lower maxillaries have two canines on each side of the symphysis. All the fins are rounded ; the dorsal spines are rather slender and a little shorter than the soft rays ; the second anal spine is longer and stronger than any of the other spines, its length equalling the extent of the base of the anal fin. The greatest vertical diameter of the body slightly exceeds  $\frac{1}{2}$  of the total length.

The stomach is moderate, coriaceous, particularly near the fundus ; the appendicula cœcopylorica are of equal length, about  $\frac{3}{8}$  inch ; the length of the intestinal canal is a little less than the total. This species, of which a single individual occurred at Pinang in 1845, agrees with the description of *Serranus stellans*, Richardson, which the author later referred to *S. hexagonatus*. In the Pinang specimen the dark spots disappeared shortly after death, leaving behind a uniform reddish brown colour.

SERRANUS LANCEOLATUS, (Bloch.)

*Holocentrus lanceolatus*, Bloch. Pl. 242, Fig. 1.

*Holocentrus lanceolatus*, Shaw. IV. 567.

Russell, CXXX. Sugglathoo Bontoo.

*Serranus lanceolatus*, Cuv. and Val. II. 316.

*Serranus lanceolatus*, Bleeker: Verh. Batav. Gen. XXII. 9, 18, 35.

"Ikan Krapu" of the Malays.

Ground-colour of the body and fins bright gamboge, with five broad vertical brown or black bands, of which the first from the orbit over the preopercle, the second from the crown of the head obliquely over the opercle to behind the pectoral fins, where it joins the third; in the obliquely oval space between these two bands some individuals have a large oval black spot; the third band which occupies the space between the 2<sup>nd</sup> and 10<sup>th</sup> dorsal spine, becomes narrower on the body and continues jointly with the second band over the abdomen; the fourth band spans nearly the whole lower half of the dorsal rays, proceeds over the body and the anal, on the posterior part of which the ground colour is visible, with one or more black spots; the fifth band is in front of the caudal; all the fins with one or more series of large black spots, more or less confluent; the pectorals in some with three arched undulating black bands; jaws with large black spots. Pupil circular black; iris golden. In the young the ground colour is citrine or sulphur.

D 11/16, C 17 $\frac{1}{4}$ , A 3/8, V 1 $\frac{1}{5}$ , P 18, Br. VII.

HABIT.—*Sea of Pinang.*

Bay of Bengal, Batavia, Samarang.

TOTAL LENGTH: 6 $\frac{1}{4}$  inch.

In three individuals examined the number of fin rays was the above stated; Russell and M. M. Cuvier and Valenciennes give the dorsal 11/14, and the latter give the anal 3/10.

*SERRANUS HORRIDUS*, Kuhl and Van Hasselt.

*Serranus horridus*, Cuv. and Val. II. 321.

*Serranus horridus*, Bleeker: Verh. Bat. Gen. XXII. 7, 19, 36.

"Ikan Krapu" of the Malays.

Crown of the head and back blackish brown; sides and abdomen brownish grey, largely marbled with blackish brown; spinous part of the dorsal yellowish pale brown, with a large basal brownish spot, between each pair of spines; the rest of the dorsal gamboge, the lower half with three or four oblique downward directed blackish bands, above which some large round black spots; caudal, anal and ventral fins gam-

boge with large round, sometimes confluent, black spots; pectorals with a large black spot in the centre of the base, and three or four more or less interrupted arched black bands. Iris blackish brown with a golden ring.

D 11/15 or 16, C 17 $\frac{3}{4}$ , A 3/8, V 1/5, P 17 or 19, Br. VII.

HABIT.—*Sea of Pinang, Singapore.*

Java.

TOTAL LENGTH: 4 feet 3 inch.

This species is closely allied to *Serranus geographicus*, Kuhl and Van Hasselt, which according to M. M. Cuvier and Valenciennes has one or two additional soft rays in the dorsal, and two in the anal fin. It attains to a gigantic size. In one, the weight of which exceeded 130 lb., the stomach contained remains of *Stromateus*, *Sphyrna blochii*, and of a *Limulus*. Though not plentiful, it is not of uncommon occurrence at Pinang, where it is valued by the natives both in its fresh and dried state. In the adult the colour of the fins is greenish olive.

*SERRANUS ALTIVELIS*, Cuv. and Val.

*Serranus altivelis*, Cuv. and Val. II. 324, Pl. 25.

*Cromileptes altivelis*, Swainson, Nat. Hist. of Fishes, II. 201.

*Serranus altivelis*, Richardson: Report 1845, 230.

*Serranus altivelis*, Bleeker, Verh. Batav. Gen. XXII. 18, 33.

Head and body brownish buff changing to white on the abdomen; fins lilac-grey; all parts with distant round black spots, edged with white; those of the body and dorsal fins larger than the rest; iris brownish buff with a narrow golden ring, the upper part with two ocelli.

D 10/18, C 17 $\frac{3}{4}$ , A 3/10, V 1/5, P 17, Br. VII.

HABIT.—*Sea of Pinang.*

Java, China Seas.

TOTAL LENGTH: 4 $\frac{5}{8}$  inch.

M. M. Cuvier and Valenciennes count 19 soft rays in the dorsal fin, but their figure represents 18; the latter is probably taken from a preserved specimen, and gives but an inadequate idea of the exquisitely delicate tints of the living fish. A single, probably young, individual observed at Pinang in June 1845, farther differs from Pl. 25, *Hist. Nat. des Poiss.* in having the dorsal spines from the third of equal length, whereas in the plate, their length is represented as gradually increasing from the first to the tenth. The very capacious stomach was expanded with remains of *Crustacea*.

**SERRANUS BONTOO, Cuv.**

Russell CXXVIII. Madinawa Bontoo.

*Serranus bontoo*, Cuvier R. A. II. 141,<sup>(3)</sup>.

*Serranus bontoo*, Cuv. and Val. II. 334.

*Serranus bontoo*: Bleeker: Verh. Bat. Gen. XXII, 9.

Brownish grey, lighter on the abdomen; head and body with numerous round blackish spots; fin membranes brownish grey; the dorsal blackish at the base and upper half. Iris pale greenish olive with a narrow golden ring.

D 11/17, C 17 $\frac{1}{2}$ , A 3/8, V 1/5, P 19, Br. VII.

HABIT.—*Sea of Pinang.*

Madras, Vizagapatam, Java.

TOTAL LENGTH: 5 inch.

A single individual with one soft anal ray less, but otherwise corresponding to the description and figure of Russell, was observed at Pinang in 1843. The lowest three teeth of the preopercle are larger than the rest. On each side of the intermaxillary bone appears a canine, stronger than the rest of the teeth. The black spots of the body become indistinct after death.

**SERRANUS COIODES**, (Buchanan Hamilton).

Russell CXXVII, Bontoo.

Bola? coioides, Buchanan Ham. 82, 369.\*

*Serranus suillus*, Cuv. and Val. II. 335.

*Serranus suillus*, Bleeker: Verh. Bat. Gen. XXII, 9.

Head, body and fins reddish ash-coloured, whitish on the abdomen, with numerous rust-coloured or orange round spots, those of the dorsal sometimes confluent, forming one or two longitudinal bands. Iris pale golden with one or two rusty spots.

D 11/15, C 17 $\frac{1}{2}$ , A 3/8, V 1/5, P 18, Br. VII.

HABIT.—*Sea of Pinang, Singapore.*

Coromandel, Bay of Bengal, Gangetic estuaries, Java.

TOTAL LENGTH: 1 foot 6 inch.

This species grows to a gigantic size. Russell saw one 7 ft. in length, 5 in circumference, weighing more than 300 lb. Smaller individuals are highly valued as articles of food. It is not numerous at Pinang.

\* An unfinished coloured sketch in the duplicate series of Buchanan's Drawings leaves no doubt of the species in question.

GEN. GENYOROGHE,\* *Cantor*.*(Equivalent to DIACOPE, Cuvier.)*

Canines among the velvety maxillary teeth; margin of preopercle toothed; opercle generally terminating in two or three flat points; margin of preopercle with a notch receiving a tuberosity of the interopercle.

## GENYOROGHE NOTATA, (Cuv. and Val.)

Russell XCVIII, *Antika Doondiawah*.

*Diacope notata*, Cuv. and Val. II. 422.

*Mesoprion russelli*, Bleeker: Verh. Batav. Gen. XXII. 20, 41.

Head above crimson; cheeks golden, margin of preopercle pale earmine; of opercle vermilion; back reddish brown; sides pale golden with red reflections; abdomen yellowish white; from the orbit, above the lateral line, three obliquely ascending orange lines, of which the lowest reaches the middle of the base of the dorsal rays; beneath which a large black spot; beneath the lateral line three or four parallel similar lines, of which the uppermost divides the black spot; the rest nearly straight from the opercle towards the tail; fin membranes yellowish; apical third of dorsal spines and rays, and upper, lower and posterior margin of caudal fin crimson; anal and ventral fins gamboge. Iris golden.

*Young*.—Head above and back brownish; cheeks, sides and abdomen, silvery white; stripes of the body brown; fine pale yellow, points of dorsal rays and posterior margin of caudal fin pale crimson.

D 10/14, C 17½, A 3/8, V 1/5, P 16, Br. VII.

*HABIT*.—*Sea of Pinang*.

Indian Ocean, Bay of Bengal, Batavia.

TOTAL LENGTH: 9 inch.

Russell gives 3/6 in the anal; M. M. Cuvier and Valenciennes 11/13 in the dorsal fin. Russell has observed the changes of colour produced by age. On each side of the throat appear three small oval fossetts, of which the posterior is the largest. The species is not numerous at Pinang.

GEN. MESOPRION, *Cuvier* 1829.

Teeth on the palate and vomer; canines among the velvety maxillary teeth; the middle of each side of the head armed with teeth like those of a saw.

\* Γένν, cheek; βέρη, cleft. Substituted for *Diacope*, Cuvier 1817, preoccupied by *Diacope*, Hübner 1816, (*Lepidopt.*)



**MESOPRION JOHNNI, (Bloch.)**

Camboto, Renard T. I. Pl. 31.

*Anthias johnii*, Bloch, IX. 97, Pl. 318.

*Lutjanus johnii*, Lacépède IV. 235.

*Sparus tranquebaricus*, Shaw IV. 471.

Russell XCVII. Doondiawah.

*Coius catus*, Buchanan Ham. 90, 369, Pl. 38, fig. 30.

*Mesoprion unimaculatus*, Quoy and Gaim. Zool. de Freyc. 304, Pl. 5.  
fig. 3.

*Mesoprion unimaculatus*, Cuv. R. A. II. 143,<sup>(3)</sup>.

*Mesoprion johnii*, Cuv. and Val. II. 443.

*Mesoprion unimaculatus*, Cuv. and Val. II. 441.

*Mesoprion unimaculatus*, Richardson : Report 1845, 229.

*Mesoprion unimaculatus*, Bleeker : Verh. Bat. Gen. XXII. 4, 20, 42.

Head above and back greyish green, opercles silvery with golden edges; sides silvery with numerous longitudinal blackish lines, produced by a central spot or line on each scale; beneath the middle of the base of the dorsal rays a large black spot, in front of which, in some, two or three blackish vertical bands, terminating a little below the lateral line; abdomen yellowish white or silvery; fins reddish yellow; upper margin of the membrane of the dorsal spines blackish; of that of the rays and the posterior margin of the caudal fin pale carmine. Iris pale golden.

D 10/14, C 17 $\frac{3}{4}$ , A 3/8, V 1/5, P. 16 or 17, Br. VII.

**HABIT.**—*Sea and estuaries of Pinang, Malayan Peninsula.*

Indian Ocean, Bay of Bengal, Gangetic estuaries, island of Lantao (Canton River), China Seas, Celebes, Amboina, Batavia, Tagal, Samarag, Surubaya, Pasuruan.

**TOTAL LENGTH :** 10 inch.

The intensity of the black lateral spot and lines differs individually, and such which habitually live in brackish muddy water, have a general blackish hue, and two or three vertical blackish bands in front of the constant lateral spot. Such was the individual first described by Bloch as *Anthias johnii*, which denomination therefore takes precedence. M. M. Cuvier and Valenciennes, indeed, question the specific difference between the latter, and *Mesoprion unimaculatus*, and point out the identity of *Coius catus*, Buch. Ham. and the present species. The first

ventral ray is elongated, but it is frequently mutilated. In some, not in all individuals, the margin of the preopercle is so deeply indented, and the tuberosity of the interopercle so conspicuous, that they might be considered species of *Genyoroge*, and as such they were considered by Kuhl. On each side of the throat appear three small oval fossets as in *G. notata*. At Pinang this species is numerous at all seasons. It is insipid; the natives however dry it.

**MESOPRION RANGUS, Cuv. and Val.**

Russell XCIV. Rangoo.

*Mesoprion rangus*, Cuv. and Val. II. 481.

*Mesoprion rangus*, Cuv. R. A. II. 144,<sup>(3)</sup>.

Head, body and fins cherry- or indian-red, lighter on the sides and abdomen; the latter in some reddish white. Iris silvery carmine.

*Young*.—Head and back purple; cheeks and sides pale indian-red; abdomen reddish white.

D 10/13, 14 or 15, C 17 $\frac{1}{2}$ , A 3/8, V 1/5, P 16, Br. VII.

**HABIT.**—*Sea of Pinang, Singapore, Malayan Peninsula.*

Java, Coromandel.

**TOTAL LENGTH:** 1 foot 8 inches.

In the upper jaw appear on each side of the muzzle two canines, of which the posterior are very large, slightly curved; on each side of the lower jaw are four similar, conical and equidistant. In the adult of this as in other species, the teeth of the margin of the preopercle become worn and indistinct. The very large, scaleless, subrhombic infraorbital bone, affords a distinguishing character. According to Russell this fish is not much esteemed. At Pinang and Singapore, where single individuals occur at all seasons, it is of excellent flavour, and considered a great acquisition to the table. At Malacca it is plentiful, and in our settlements in the Straits it is known under the denomination of the "red rock-cod."

**MESOPRION ANNULARIS, Cuv. and Val.**

*Mesoprion annularis*, Cuv. and Val. II. 484, III. 497.

*Diacope annularis*, Rüppell: Atlas, 74.

*Diacope annularis*, Rüppell, Neue Wirb. Fische. 91.

Quoy et Gaimard, Astrol: Pl. 5, fig. 4.

*Mesoprion annularis*, Richardson: Rep. 1845, 229.

*Mesoprion annularis*, Bleeker: Verh. Bat. Gen. XXII., 4, 22, 47.

Head above and back brown with a crimson hue, paler on the cheeks and sides; abdomen silvery rose-coloured; across the back between the opercles, a broad forwards arched black band; in front of the root of the caudal fin, on each side, a large round black spot: both joined on the back, and both with a broad white margin, except on the back; dorsal spines crimson, the lower half of the rest of the dorsal fin reddish brown, the upper half crimson; the anterior half of the caudal fin reddish brown; posterior half pale crimson; the upper half of the anal silvery reddish brown, the rest black; the anterior third of the ventrals white, the rest black; pectorals pale rose-coloured. Iris golden with crimson hue.

*Young*.—Colours generally paler and the black marks less distinct.

D 11/13 or 14, C 17½, A 3/9, V 1/5, P 16 or 17, Br. VII.

*HABIT*.—*Sea of Pinang, Singapore, Malayan Peninsula.*

Indian Ocean, Massaua (Red Sea), Ceylon, China Seas, Batavia, Bantam, Cheribon, Samarang, Surubaya, Passuruan, Patjitan, Celebes.

**TOTAL LENGTH:** 7 inch.

The brown oblique lines of the body, described by M. M. Cuvier and Valenciennes, do not exist during life, but appear after death, as the original colours fade. The ascending margin of the preopercle is very minutely toothed, but the lower part is very strongly so; the latter is arched, but there is scarcely any notch where it joins the ascending straight part. This species is distinguished by the beauty of its colours no less than by the symmetry of its forms. It feeds upon *crustacea*. A few occur at times at Pinang.

**MESOPRION GEMBRA**, (Bloch-Schneider,)

*Alphestes sambra*, and *gembra*, Bloch-Schneider, page 236, Pl. 51, fig. 2.

*Mesoprion gembra*, Cuv. and Val. II. 485.

*Mesoprion gembra*, Cuv. R. A. II. 144, (3).

Upper part of the head and the back blackish brown; cheeks and sides silvery brownish grey; abdomen whitish; from occiput to the tail numerous (from 10 to 15) vertical brownish black bands, terminating near abdomen, with intervals narrower than the bands themselves; apical part of dorsal spines and margin of their membrane pale crimson; the membrane with a transversal central series of brownish spots; up-

per third of the rest of the dorsal fin pale blackish, central third whitish, basal pale yellowish brown; anterior third of the caudal fin pale yellowish brown, central whitish, posterior blackish; lower third of anal blackish, the rest successively as the caudal; pectorals and ventrals whitish, the lower half of the two anterior ventral rays, and their connecting membrane pale crimson, a large brownish central spot between the 2<sup>d</sup>, 3<sup>d</sup> and 4<sup>th</sup> ventral ray. Iris pale golden, blackish near the orbit.

*Young*.—Ground colour and black bands less distinct; between the dorsal rays some irregular series of brownish dots; posterior half of ventral fins blackish; no crimson on this nor the dorsal fin.

D 10/13 or 14, C 17½, A 3/8, V 1/5 P 17, Br. VII.

HABIT.—*Rivulets of Pinang*.

Tranquebar.\*

TOTAL LENGTH: 5½ inch.

The anterior ventral ray is elongated, bristle-like. In the peculiar distribution of colours this species much resembles a *Datnia* from the estuaries of the Ganges described and figured by Buchanan Hamilton as *Coina polota*,† (pp. 25, 370, Pl. 38, fig. 31.) From the latter the present differs not only in the number of its branchiostegous- and fin-rays, but also by its more elongated form. But two individuals were at different times observed at Pinang: both were taken in rivulets, which however communicate with the sea.

MESOPRION CAROUI, Cuv. and Val.

*Mesoprion caroui*, Cuv. and Val. II. 489.

Russell CXXV. Karooi.

Head above and back reddish brown; cheeks and sides silvery brownish yellow; abdomen white; between the back and the lateral line a number of more or less distinct oblique brownish lines; from the posterior margin of the orbit a reddish light brown band to the tail; from the opercle four undulating reddish brown lines, converging towards the tail; fins brownish yellow. Iris brownish golden.

D 11/12, C 17½, A 3/8 or 9, V 1/5, P 16, Br. VII.

\* According to Bloch.

† Referred by M. M. Temminck and Schlegel as a second species of their genus *Anoplus*. The latter name however is inadmissible, as it has been preoccupied by *Anoplus*, Schönherr, 1826, (*Coleopt.*)

HABIT.—*Sea of Pinang.*

Madras, Vizagapatam.

TOTAL LENGTH,  $4\frac{1}{2}$  inch.

Russell counted 9 anal rays : a single individual observed at Pinang had but 8. The margin of the preopercle is finely toothed, except at the angle where the teeth are stronger.

GEN. *NANDUS*, Cuv. and Val. 1831.

Mouth very protractile, with velvety teeth in both jaws, on the palate and vomer ; margin of preopercle and interopercle finely toothed ; spine of opercle very minute.

*NANDUS MARMORATUS*, Cuv. and Val.

*Coius nandus*, Buchan. Ham. 96, 370, Pl. 30, Fig. 32.

*Nandus marmoratus*, Cuv. and Val. VII, 482, Pl. 207.

(Icon.) *Bedula hamiltonii*, Gray, Ill. Ind. Zool. II. Pl. 88, Fig. 3.

*Bedula nebulosus*, Gray, *Ibid.* Fig. 2.

*Coius nandus*, McClelland, Calc. Jour. Nat. Hist. II. 574.

Head and body silvery or golden greenish olive, lighter on the sides ; cheeks and abdomen silvery with rose-coloured or orange reflections ; on the head and body large dark olive patches, edged with black dots, in some disposed like irregular vertical bands ; on the cheeks two or three such, radiating from the orbit ; in most a greenish black oval spot on the middle of the side of the tail ; spines and fin-membranes transparent, minutely dotted with black, marbled with pale brownish lake and greenish olive ; pectoral rays pale greenish olive, minutely dotted with black ; rest of the rays pale brownish red with transversal greenish black bars. Iris golden greenish olive, minutely dotted with black, with a narrow golden circle round the pupil ; upper orbital margin black.

D 13/12, C  $12\frac{1}{2}$ , A  $3\frac{7}{8}$ , V  $1\frac{1}{5}$ , P 16, Br. VI.

Rarely : D 12/13 or 13/11 or 14/12, C 17 or  $18\frac{1}{2}$ , A  $3\frac{7}{8}$  or 9, P 17 or 18.

HABIT.—*Fresh water Malayan Peninsula.*

Bengal (in pounds), Sutlej, Chenaub (at Ramnuggur).

TOTAL LENGTH, 6 inch.

The length of the head is about  $\frac{1}{3}$  of the total ; the vertical diameter at occiput is  $1\frac{1}{2}$  of the length. The eye nearly borders the profile, the diameter is in the young  $4\frac{1}{2}$ , in the adult  $\frac{1}{2}$  of the length of the head ; the distance from the muzzle is  $1\frac{1}{2}$  diameter, from the flat mem-

branous point of the opercle  $2\frac{1}{2}$  diameter. The openings of the nostrils are situated closely in front of the orbit. Between the centre of the supraorbital margin and the muzzle appear three distant fossæ; on the infraorbital bone two or three; beneath the symphysis of the lower jaw two pores, and behind them on each branch of the jaw two fossæ. The teeth are minute inwardly pointing, like those of a card; in the intermaxillaries they are placed 3 to 4 deep, but they become more crowded beneath the symphysis, where those of the innermost series are a little, yet perceptibly, longer than the rest. Such is also the case with those of the symphysis of the lower jaw, but on the branches they are placed in a single series, and are somewhat distant from each other. The vomer is raised into an acute angular crest, surmounted by a series of minute pointed teeth; the palatal, pharyngeal and those at the root of the flattened membranous tongue are very minute velvety. The greatest vertical depth of the body, at the seventh dorsal spine, is  $\frac{3}{4}$  of the length of the head. The lateral line consists of a series of minute tubes, bifid at each extremity; it follows on the upper fourth of the side the arch of the back towards the termination of the dorsal, where it is suddenly interrupted, but it reappears lower down, and proceeds straight in the middle of the tail to the caudal. This fish is as numerous in the Malayan Peninsula as in Bengal. It is of voracious habits, preying upon small *Cyprinoidæ*, and as observed by Buchanan, is very tenacious of life. The longitudinal mark of the scales, described and figured by Buchanan, does not exist in the living fish, but appears after death. Buchanan Hamilton has correctly described the teeth: "intermixed with these, in each jaw, are several sharp teeth of a larger size." Such is the case in Bengal and Malayan specimens. Those examined by M. M. Cuvier and Valenciennes appear to have been defective in this character, and they therefore express some doubt about the identity of the species. As yet however, no other species of *Nandus* has been discovered. They have corrected the error of Buchanan in counting seven, instead of six branchiostegous rays. The figure of *Bedula nebulosa*, Ill. Ind. Zool. appears to be intended to represent the present species, but whether the defect is attributable to the original specimen, or to the copyist, is impossible to ascertain. The figure of *Bedula hamiltonii*, is inferior to that of Buchanan Hamilton, and the colours are those of a specimen preserved in spirits of wine.

## GEN. THERAPON, Cuv. and Val. 1829.

Preopercle toothed, opercle terminating in a strong spine; dorsal fin deeply emarginated between the spinous and soft part; the external series of teeth stronger than the rest, conical; teeth of the vomer apt to fall out; airvessel divided by a stricture in two compartments.

## THERAPON TRIVITTATUS, (Buchanan Ham.)

Russell CXXVI. Keelputa.

*Coius trivittatus*, Buchan. Ham. 92, 370.

*Therapon puta*, Cuv. and Val. III. 131, and 144, ("un thérapon, [le trivittatus].")

*Icon. Pterapon trivittatus*, Gray: Ill. Ind. Zool. II. Pl. 88, Fig. 1.

*Pterapon trivittatus*, (Syn. *Therapon theraps*) Richardson's Report, [1845, 238.

*Therapon puta*, Bleeker: Verh. Batav. Gen. XXII. 23, 50.

Head above and back pale greyish green, sides silvery, abdomen white; from the first dorsal ray to the middle of the base of the soft part a brownish or black slightly downward arched band; a second from the nape of the neck towards the root of the upper margin of the caudal fin; a third, paler, from the opercle to the centre of the caudal; fin-membranes white, upper half of the membrane between the six anterior dorsal spines, and in some between the ninth and tenth, black; the upper margin of the soft dorsal with one or two black spots; caudal with a central horizontal blackish band, above and below which two, more or less distinct, oblique black bands; posterior half of anal, and anterior half of ventral fins pale ochre. Iris golden; pupil broad lanceolate with the apex forward.

D 11/10, C 17 $\frac{1}{4}$ , A 3/8, V 1/5. P 13, Br. VI.

HABIT.—*Sea of Pinang, Singapore, Malayan Peninsula.*

Bay of Bengal, estuaries of the Ganges, Batavia.

TOTAL LENGTH, 6 inch.

This species is well marked by three or four teeth at the angle of the preopercle, conspicuously larger than the rest. Buchanan Hamilton describes *Coius trivittatus* (l. c. 93), as having "the four lower toothlets" (of the preopercle) "larger than the others." In his duplicate series of drawings is a correct representation of this species, marked in his handwriting as "*Holocentrus Katkaya*." Buchanan's drawing is evidently the original of the figure in Hardwicke's Illustrations

named *Pterapon trivittatus*. In the copy however, the distinguishing character is not represented, nor is Buchanan's name affixed to the specific. The incorrectness of the copy has caused Sir John Richardson to consider it as intended to represent *Therapon theraps*, Cuv. and Val., and he consequently placed, as a synonym of the latter, *Pterapon trivittatus*, "Gray," an entirely distinct species, first described by Buchanan Hamilton (Richardson : Report 1845, 238.)

M. M. Cuvier and Valenciennes count 12/10 or 10—1/10 in the dorsal, and 3/9 in the ventral fins. In colours the young resemble the adult, but the distinctness of the lateral bands varies individually in all ages, and in some they are greenish, instead of black. The young have velvety teeth on the vomer, but they disappear with age. In the Straits of Malacca the species is numerous at all seasons.

**THERAPON OBSCURUS, Cuv. and Val.**

*Therapon obscurus*, Cuv. and Val. III. 135.

*Therapon obscurus*, Bleeker : Verh. Batav. Gen. XXII. 23, 51.

Pale blackish or bluish silvery, with two broad longitudinal white bands on the sides ; abdomen white ; dorsal and caudal fins coloured like *T. trivittatus*, lower half of the anal and ventral fins blackish ; body and fins minutely dotted with black. Iris pale golden, black towards the orbit.

*Young.* Of a general darker colour than the adult.

D 12/10 or 11, C 17 $\frac{2}{3}$ , A 3/8, V 1/5, P 13 or 14, Br. VI.

**HABIT.**—*Sea of Pinang.*

Indian Ocean, Batavia.

**TOTAL LENGTH,** 4 $\frac{1}{2}$  inch.

This species may readily be distinguished from the preceding by its shorter, broader shape, by the uniformly toothed preopercle, and the smaller spine of the opercle. From *Therapon squalidus*, Cuv. and Val. it differs in having but 7 cæcopyloric appendages. It is of rare occurrence at Pinang. In the young of this species as well as of *T. trivittatus*, the suprascapular and humeral bones are not crenulated, but they become so in the adult.

**GEN. SILLAGO, Cuvier, 1817.**

Head elongated, slightly pointed ; mouth small ; velvety teeth in the jaws and in front of vomer ; opercle terminating in a small point ; six branchiostegous rays ; two contiguous dorsal fins, of which the an-



terior with thin spines, the posterior is long and little elevated.

**SILLAGO MALABARICA, (Bloch. Schneider.)**

*Sciæna malabarica*, Bl. Schn. Pl. 19.

Russell CXIII. Soring.

*Sillago malabarica*, Cuv. R. A. II. 149.

*Sillago acuta*, Cuv. and Val. III. 400.

*Sillago acuta*, Bleeker : Verh. Batav. Gen. XXII. 25, 61, 4.

"Ikan Ubi" of the Malays of Pinang.

Head above pale reddish purple; cheeks pale orange; opercles bluish silvery; back pale greenish; sides pale reddish silvery, with a silvery longitudinal band beneath the lateral line; abdomen mother-of-pearl; membrane of dorsal fins with some minute oblique black lines, particularly near the anterior margin of the spines and rays, where they in some form faint blackish vertical lines; the rest of the fins whitish or pale yellowish. Iris pale golden.

D 10 or 11—1/21, C 17 $\frac{1}{2}$ , A 1/23, V 1/5, P 15, Br. VI.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Bay of Bengal, estuaries of the Ganges, Macao, Bantam, Batavia, Tjilatjap, Samarang, Surabaya, Passuruan, Bangkallang, Makassar, Celebes, Sumbawa.

TOTAL LENGTH, 1 foot.

Although this species occurs at Pinang in numbers at all seasons, it is never very plentiful. *Sillago domina*, Cuv. and Val. which is very numerous at Pondicherry, Madras, and indeed as far north as the mouths of the Ganges, appears to be unknown at Pinang and Singapore. The length given of the present species is the greatest observed, but M. Leschenault has seen single individuals upwards of three feet.

**GEN. URANOSCOPIUS, Gronov. 1754.**

Head large, depressed, rough; eyes and mouth vertical; lower part of preopercle crenate; shoulder with a strong spine; branchiostegous rays six; dorsal fins two, or both united into one; vent central.

**URANOSCOPIUS COGNATUS, Cantor.**

Head above and back pale brownish green, cheeks, sides and abdomen silvery, minutely dotted with black; jaws blackish; anterior dorsal fin black, near the base clouded whitish; posterior dorsal whitish, minutely dotted with black between the branches, and along the upper half of the rays; caudal bright gamboge; the membrane

between the branched part of the rays white, and along the branches minutely dotted with black; anal and ventral fins white; pectorals white, minutely dotted with black, the apex of each ray scarlet. Iris pale golden green, blackish towards the orbit; pupil very minute, like a brilliant black point.

D 3—1/15, C 12½, A 14, V 1/5, P 18, Br. VI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH, 5½ inch.

Except in colours and in the number of fin-rays, this species so closely resembles *Uranoscopus scaber*, Linné, that it will be sufficient to point out the differences. The eyes are vertical, and the very small circular pupils are directed upwards, but the level of the orbit is somewhat sloping, the outer margin being lower than the inner; the orbit itself is oval, its greatest diameter, equalling the distance between the eyes across the vertex, is oblique, slightly diverging forward from the medial line of the vertex. The length of the head from the lower jaw to the nape of the neck slightly exceeds ¼ of the total, but measured to the apex of the opercle it slightly exceeds ½ of the total length. The anterior process of the infraorbital bone covering the maxillary, terminates in an obliquely downward pointed spine, which is rugged or shagreened like the rest of the covering of the head. The lips have a series of close fleshy papillæ. The upper maxillary teeth are in two series, of which the outer is the more minute, those in the centre of the inner series are stronger than the rest; the lower jaw has on each side four or five long, distant, recurved teeth; on the symphysis they are closer, in two series, of which the inner contains the longer teeth. The four spines of the lower margin of the preopercle are placed by a central interval in two pairs: an anterior, and a posterior. Of the four indentations or shallow depressions of the ascending margin, the uppermost is the smallest. The lower part of the posterior margin of the opercle has a finely toothed appearance, produced by some oblique ridges terminating there. The strong vertical spine of the subopercle is on a level with the four spines of the preopercle. In front of the anterior of the latter is a small broad triangular spine. Between and beneath the angles of the lower jaw appear on each side three forward pointed spines, of which the superior, the longest, is directed obliquely downward, and touches

the opposite one; the other two pairs are vertical, the posterior being the shorter. The scapular spines are small, but distinct; the humeral spine is very strong, triangular and longitudinally furrowed like a bayonet; its length is little less than  $\frac{1}{2}$  of the pectoral fin, or equal the upper margin of the opercle. The length of the pectorals equals  $\frac{1}{2}$  of the total; the inferior eight rays are thicker than the rest. The ventrals are less than  $\frac{1}{2}$  of the total. The anterior dorsal is triangular, its height less than  $\frac{1}{2}$  of the vertical diameter of the body, which is contained about  $4\frac{1}{2}$  times in the total length. The posterior dorsal commences with a short, thin spine, which so closely reclines towards the back, that it easily may escape observation; the first three rays are undivided, gradually increasing in length; the fourth is the longest, about  $\frac{2}{3}$  of the vertical diameter of the body; the fifth and sixth are shorter; the rest nearly equal about  $\frac{1}{2}$  of the length of the fourth ray. The rays of the anal fin are somewhat shorter, but not thicker than those of the posterior dorsal. The precise shape of the fin could not be ascertained, as it happened to be somewhat mutilated in the only individual observed. The naked space behind the posterior dorsal and that behind the anal, is a little more than  $\frac{1}{12}$  of the total length; the caudal is about  $\frac{1}{2}$ . The space on the back between the lateral lines is covered with scales like those of the rest of the back, sides, and the posterior half of the abdomen; the anterior half of the latter and the chest are apparently naked. Of the Asiatic species, described by M. M. Cuvier and Valenciennes, the present nearest approaches *U. marmoratus*, which differs in colours, in the smaller humeral spine, in having five preopercular teeth, the space between the lateral lines naked, and the skull is shagreened but on the posterior part only. The capacious, leathery stomach contained remains of minute *Crustacea* and mud; its length ( $4\frac{1}{2}$  inch.) a little less than  $\frac{1}{2}$  of the total; that of the intestinal canal  $4\frac{1}{2}$  inch. There were eight cæcopyloric appendages. The gall-bladder excessively large, elongated, bottle shaped, in length nearly equalling the stomach, transparent pale greenish. The fishermen of Pinang asserted this species to be of very rare occurrence and to grow but little larger.

GEN. SPHYRÆNA, *Artedi*. 1738.

Body elongated with two separated dorsal fins, head oblong, with the lower jaw projecting in a point beyond the upper; some of the

teeth large, pointed, trenchant; preopercle not toothed; opercle without spines; branchial rays seven; cæcopyloric appendages numerous.

*SPHYRÆNA JELLO*, Cuv. and Val.

Russell CLXXIV. Jello.

*Sphyræna jello*, Cuv. and Val. III. p. 349.

*Sphyræna jello*, Bélanger, Voy. Zool. p. 346, Pl. I. Fig. 1.

*Sphyræna jello*, Rüppell, N. W. Fische, p. 98.

? *Sphyræna jello*, Bleeker: Verh. Batav. Gen. XXII. 24, 56, 4.

Head above and back dark greyish green, forming on the upper part of the sides a festooned band, intersecting the lateral line; cheeks and sides pale silvery, abdomen white; ventral fins whitish, the other fins pale yellowish; dorsals, caudal and pectorals minutely dotted with black near the margins. Iris pale golden, blackish near the orbit.

D 5—1/9, C 17½, A 1/8 or 9, V 1/5, P 13 or 14, Br. VII.

HABIT,—*Sea of Pinang, Singapore.*

Bay of Bengal, Red Sea.

TOTAL LENGTH, 1 foot 6 inch.

The length of the head is 3½ of the total, taken from the symphysis of the lower jaw to the centre of a vertical line cutting the lobes of the caudal; but taken from the symphysis to the centre of the caudal itself, the head is 3½ of the total. The horizontal diameter of the oval eye is ½ of the length of the head. The opercle terminates in two small, flat, membranous points.

At Pinang a few at the time occur at all seasons. The length given is the common, but according to Russell an individual of 4 feet has been observed. In one examined the stomach contained remains of *Trichiurus*. The airvessel is long, cylindrical.

*SPHYRÆNA OBTUSATA*, Cuv. and Val.

? *Sphyræna chinensis*, Lacépède, Pl. 10, Fig. 2

*Sphyræna obtusata*, Cuv. and Val. III. 350.

? *Sphyræna obtusata*, Bleeker: Verh. Batav. Gen. XXII. 24, 56, 4.

Head above and back dark greyish green, paler on the upper part of the sides, and clouded beneath the lateral line, cheeks and the rest of the sides pale silvery; abdomen white; pectorals and ventrals whitish, the other fins and the iris like *S. jello*.

D 5—1/9, C 17½, A 1/9, V 1/5, P 13, Br. VII.

HABIT.—*Sea of Pinang, Singapore.*

Port Jackson, Isle of France, Malabar, Pondicherry,  
Batavia, Surabaya.

TOTAL LENGTH : 2 feet 6 inch.

The length of the head from the symphysis to the centre of the posterior caudal margin is about  $\frac{1}{3}$  of the total length. The horizontal diameter of the oval eye is  $\frac{1}{4}$  of the length of the head : the eye consequently appears comparatively larger than in *S. jello*. The opercle terminates in a single flat, membranous point ; the preopercle is not rounded, but almost rectangular ; the symphysis of the lower jaw is obtuse, and less prominent than in *S. jello*. There are but three longer teeth (the second, third and fourth,) in front on each side of the palatals ; the rest are all uniformly small. The ventral fins are not situated opposite the anterior dorsal, at the termination of the pectorals, but in front of the anterior dorsal, opposite the posterior half of the pectorals. The caudal fin is less deeply cleft than in *S. jello*. At Pinang a few individuals occur at all seasons.

GEN. POLYNEMUS, *Gronov.* 1754.

(PENTANEMUS, *Artedi.*)

Head compressed, covered with scales ; muzzle obtuse, prominent ; branchiostegous rays 7 ; pectoral fins with distinct appendages.

POLYNEMUS TETRADACTYLUS, *Shaw.*

? *Trigla asiatica*, Linné, Syst. 1345.

Russell CLXXXIII. *Maga Jellec*.

*Polynemus tetradactylus*, Shaw, V. 155.

*Polynemus teria*, Buchan. Ham. 224, 381.

*Polynemus tetradactylus*, Cuv. and Val. III. 375.

(*Icon.*)—*Polynemus teria*, Gray : Ill. Ind. Zool. I. Pl. 92, Fig. 2.

*Polynemus salliah*, Cantor : Journ. Royal As. Soc. V. 166.

*Polynemus quadrifilis*, Cantor : l. c.

*Polynemus tetradactylus*, Swainson : Nat. Hist. Fish. II, 234.

*Polynemus tetradactylus*, McClelland : Journ. As. Soc. VIII.

*Polynemus tetradactylus*, Royle : On Isinglass, 25, 26.

*Polynemus tetradactylus*, Penny Cyclop. Vol. XVIII. p.  
360, Note.

*Polynemus tetradactylus*, Richardson, Report 1845, 218.

*Polynemus tetradactylus*, Bleeker : Verh. Batav. Gen. XXII.

24, 57.

Ikan Salangan, 'Sinanghi,' or 'Salanghi' of the Malays,

Head silvery ; back and sides silvery green ; the latter beneath the lateral line, silvery ; abdomen white ; pectoral, ventral and anal fins gamboge or pale orange ; dorsals and caudal greyish, minutely dotted with black, their margins broad blackish ; filaments white ; iris silvery, metallic green at the upper part of the orbit.

D 8 or 9— $1/14$  or 15, C  $17\frac{1}{2}$ , A 3 or  $4/15$  or 16, V  $1/5$ , P 17, Filaments 4, Br. VII.

HABIT.—*Sea of Pinang, Singapore, Malayan Peninsula, Laccary.*

Bay of Bengal, Gangetic estuaries ; Australia, China, Bantam, Batavia, Tjilatjap, Samarang, Surabaya, Bangkallang.

TOTAL LENGTH : 4 feet.

It is highly valued as an article of food, its flavour being compared with that of salmon. In the Straits of Malacca single individuals occur at all seasons, but it is there not numerous as it is in the Bay of Bengal, and the Gangetic estuaries, nor of such gigantic dimensions as Buchanan Hamilton describes it to attain in the latter locality. Some individuals which in 1837 were observed in the Bay of Bengal, and by the native fishermen denominated *Salliah* or *Saccolih*, I was induced to consider as belonging to a distinct, although closely allied species, (*P. salliah*.) as they all agreed in presenting one dorsal, and two anal-spines more than were attributed to *P. tetradactylus*. The following is the number of fin-rays given by the different describers :

*Russell* : D 8— $1/14$ , C 22 ? A  $1/16$ , V  $1/5$ , P 17.

*Buchanan* : D 8— $1/14$ , C 15+, A  $2/15$ , V  $1/5$ , P 17.

*Cuv. and Val.* : D 8— $1/15$ , C 17, A  $1/16$ , V  $1/5$ , P 17.

The first anal spine is very minute, and as well as the succeeding one or two almost hid by scales, particularly in larger individuals. Although the figure of this species in Buchanan Hamilton's duplicate drawings represents the anal fin with *four spines* and fifteen rays, his description gives but  $2/15$ . The length of the filaments is liable to individual variation, and in the adult they are comparatively shorter than in the young. Normally the two posterior are the longest, equalling the length of the head ; the first is but  $\frac{1}{4}$  of the fourth.

The ascending margin of the preopercle is very finely toothed, but the lowest tooth is conspicuously larger than the rest. The lateral line is nearly straight from its posterior half. From the base of the caudal it continues sloping a little downwards on the lower half of the fin, and divides in two or three horizontal branches, which reach the margin of the fin. A little behind the place where the cystic and hepatic ducts jointly enter the duodenum, the latter sends forth three branches which again terminate in innumerable cœcopyloric appendages. This species, as first observed by M. M. Cuvier and Valenciennes, has no air vessel.

**POLYNEMUS PLEBEIUS, Broussonnet.**

*Polynemus plebeius*, Emoi, Broussonnet : Fasc. I. Pl. 7.

*Polynemus plebeius*, Linné, Syst. 1401.

Bynni, Bruce, Appendix.

*Polynemus plebeius*, Bloch.

*Polynemus lineatus*, Lacépède V. 409, Pl. 13, Fig. 2.

*Polynemus plebeius*, Shaw, V. 150, Pl. 125, Bynni Carp.

*Polynemus niloticus*, Shaw, *ibid.* 151.

*Polynemus commersonii*, Shaw, *ibid.* 156.

*Polynemus plebeius*, Cuv. and Val. III. (380. *Excl. Syn. P. sele*,  
*Buchan.*)

*Polynemus plebeius*, Temminck and Schlegel : Fauna, Jap. Pisc. 29,  
Pl. XI. Fig. 1.

*Polynemus plebeius*, McClelland, Cal. Journ. of Nat. Hist. Vol.  
III. p. 185, (*Excl. Syn. P. sele and the accomp. Pl. VI. P. sele.*)

*Polynemus plebeius*, Richardson : Report 1845, 219, (*Excl. Syn.*  
*P. sele.*)

*Polynemus plebeius*, Bleeker, Verh. Batav. Gen. XXII. 25, 58.  
(*Excl. Syn. P. sele.*)

Head above and back greenish grey, or pale bluish silvery ; sides pale silvery ; abdomen white ; fins whitish grey, minutely dotted with black ; dorsals, caudal and pectorals with pale blackish margins. Iris silvery, metallic green at the upper part of the orbit. Filaments white.

D 8—1/13 or 14, C 17½, A 3/12 or 13, V 1/5, P 13 or 14, Filaments 5, Br. VII.

HABIT.—*Sea of Pinang.*

Otaheiti, Isle of Tanna, Isle of France,

Coast and estuaries of Coromandel, Japan, Polynesia,  
Batavia, Samarang, Surabaya, Sampang, Madura.

TOTAL LENGTH, 1 foot :

The length of the head is  $\frac{1}{4}$  of that of the body, measured from the muzzle to the centre of the caudal margin ; but in the length taken from the muzzle to the centre of a vertical line cutting the lobes of the caudal, that of the head is contained  $4\frac{1}{2}$  or five times, according to the individually varying length of the caudal fin. The horizontal diameter of the eye is contained  $3\frac{1}{2}$  times in the length of the head. The preopercle is more finely toothed than it is in *P. tetradactylus* : the lowest tooth is longer than the rest. The anterior dorsal fin commences opposite the posterior extremity of the opercle, the extent of the base being  $\frac{1}{4}$  of the length of the third spine. The posterior dorsal commences a little in front of the anal, the extent of its base equalling the length of the third dorsal spine. The distance between the two fins exceeds by  $\frac{1}{4}$  the extent of the base of the anterior dorsal, while it is but little less than the extent of the base of posterior dorsal. The two or three posterior filaments are longer than the pectoral fin. The lateral line is nearly straight towards the root of the caudal, over which it extends in a downward slightly oblique direction to a little beneath the cleft. The caudal fin is more or less deeply cleft, the upper lobe in some individuals is longer than the lower ; both are pointed, but neither terminates in a filament. In a fresh state no longitudinal dark lines appear on the body, but in the young three or four of the scales of the lateral line near its origin, are densely dotted with black, so as to appear like a blackish serrated spot. The individuals observed at Pinang differ from the description of *P. plebeius* by M. M. Cuvier and Valenciennes in having three or four pectoral rays less, and three anal spines instead of two, but the first of the three is so short, and so hid by the scales, that it easily may escape observation. In other external characters there is no difference, and they also agree in presenting a great number of cœcopyloric appendages, and in having an elongated narrow airvessel, *without appendages*. At Pinang this species is of rare occurrence, and of the few observed, the largest measured but one foot in length. Its value as a fish yielding isinglass requires to be ascertained in localities which it frequents, and where it attains its full size : 4 ft.



## POLYNEMUS INDICUS, Shaw.

Russell CLXXXIV. Maga Booshee.

*Polynemus indicus*, Shaw, V., 155.

*Polynemus sele*, Buchanan, 226, 381.

*Polynemus uronemus*, Cuv. and Val. III. 385.

*Polynemus indicus*, Swainson, Nat. Hist. Fish, II. 234.

*Polynemus sele*, McClelland, Journ. As. Soc. Vol. VIII. p. 203, Plate.

*Polynemus sele*, Cantor, Proc. Zool. Soc. Pt. VII.

*Polynemus sele*, McClelland, } Cal. Journ. N. H. Vol. II. p.

*Polynemus plotenus*, McClelland, } 450.

*Polynemus plebeius*, McClelland,

*Polynemus sele*, McClelland, } Ibid Vol. III. pp. 179, 181,

*Polynemus lineatus*, McClelland, } Pl. VI.

*Polynemus gelatinosus*, McClelland, }

*Polynemus uronemus*, Bleeker, Verh. Batav. Gen. XXII. 25, 58.

Ikan Kúrow of the Malays.

Head above dark bluish, or greyish, lighter greyish on the sides; abdomen white; opercle bluish silvery with a blackish spot on the upper half; the body everywhere more or less densely dotted with black; pectorals black, the other fins greyish or bluish white, dotted with black, often so densely as to give the dorsals, ventrals, the anal and the caudal a blackish appearance; the filaments of the caudal lobes black; the anterior half of the pectoral filaments white, the posterior blackish. Irish silvery.

D 8—1/13 or 14, C 17 $\frac{1}{7}$ , A 3/11 or 12, V 1/5, P 13 or 14, Filaments 5, Br. VII.

HABIT.—*Sea of Pinang, Singapore, Malayan Peninsula.*

Pondicherry, Madras, Vizagapatam, estuaries of the Ganges,  
Surabaya.

TOTAL LENGTH: 3 feet.

The length of the head is contained about 3 $\frac{1}{4}$  times in that of the body, measured from the muzzle to the centre of the caudal margin. The horizontal diameter of the eye is about  $\frac{1}{4}$  of the length of the head. The ascending margin of the preopercle is more strongly toothed than in *P. plebeius*, the lowest tooth being the longest. The anterior dorsal commences behind the termination of the opercle, opposite the second half of the pectoral fin, the extent of its base

being nearly equal to the length of the fourth spine. The posterior dorsal commences considerably in front of the anal, the extent of its base equalling the third dorsal spine. The distance between the two fins is nearly equal the base of the anterior dorsal. The two or three posterior or upper filaments are longer than the pectoral fins. In the young they are comparatively larger: one or two reaching to the anal fin. The lobes of the caudal fin are unequal, the lower being, generally, but not always, the longer. The length of the caudal filaments is greater in the very young, in which the lower almost equals the length of the body. The lateral line proceeds nearly straight to the centre of the root of the caudal, from whence it is continued obliquely downwards over the lower lobe. The most striking character by which this species at once may be distinguished from *P. plebeius* is the structure of the airvessel, of which M. M. Cuvier and Valenciennes observe: "its membrane is silvery, thick, the general form oval. It occupies the whole length of the stomach, terminating behind in a very sharp point, which penetrates the thick of the tail over the first interspinal of the anal. It adheres to the third, fourth, fifth, sixth and seventh abdominal vertebræ. From both sides towards the ventral surface, proceed twenty-eight to thirty-five appendages, which, with the exception of the three last ones, have two roots, but terminate in a single sharp point. Above each of these, towards the dorsal surface, appear one or two others. All the appendages penetrate the thick of the muscles, and are slightly directed towards the back of the fish." (Hist. Nat. des Poiss. T. III. p. 285.) Also this species is distinguished by a very great number of cœcopyloric appendages, divided in two portions: one containing the longer and larger, adheres to the stomach, the other to the intestine. At Pinang single individuals occur at all seasons, but numbers are taken from June to August. The weight is commonly from 4 to 6 lb, seldom exceeding 20. The airvessel of a good-sized fish when dried, and ready for the market in China, weighs upwards of 2 ounces, is considered very good isinglass, and fetches 25 to 30 Spanish Dollars per Pikul. The fish itself is valued as an article of food, although less so than *P. tetradactylus*.

*Synonymy of Polynemus indicus.*

Russell, the first describer of this species, has also published the only correct figure, No. CLXXXIV. His formula of the fin-rays is:

D 8—1/14, C 20, A. 3/13, V 1/5, P 17.

Shaw, quoting the description of Russell, named the species *P. indicus*, which denomination, however objectionable, claims priority.

Buchanan Hamilton described this species as *P. sele*, which he observed strongly resembles the description of Russell's No. CLXXXIV. but he strangely misunderstood Russell's formula of the anal fin, so as to believe that it expressed "two fins behind the vent," and concluded that *P. sele* must be identical with *P. plebeius*. As to the identity of *P. sele*, there can be no doubt, as there exists in the duplicate series of Buchanan's drawings, a coloured figure, which although not quite correct, it is but justice to add, is far superior to the two copies of the drawing published by Mr. McClelland.

M. M. Cuvier and Valenciennes, who could judge of *P. sele* but by the in part erroneous description of Buchanan, admit on his authority its identity with *P. sele*, not however without expressing a doubt.

Mr. McClelland, in *Journ. As. Soc.* Vol. VIII. p. 203, published a description of "*Polynemus sele*," and a copy of the drawing in Buchanan's duplicate series. The fin-rays are given as follows :

D 7—14, C 20 (?), A 12 or 13, V 6, P. 13.

The airvessel is described as "a large spindle-shaped organ about half the length of the fish, thick in the middle and tapering towards the extremities where it ends in front by two, and behind by a single tendinous cord ; similar small tendinous attachments, about twenty-two in number, connect it on either side to the upper and lateral parts of the abdominal cavity." The characteristic form of this organ was first observed by M. M. Cuvier and Valenciennes, and a reference to their description of *P. uronemus* (*P. indicus*, Shaw) might have proved the identity of that and *P. sele*. Notwithstanding the distinctive character presented by the airvessel of this species, Mr. McClelland in an editorial "On the East Indian Isinglass" (*Cal. Journ. of Nat. Hist.* Vol. III. p. 179) asserts, "*Polynemus plebeius*, *P. lineatus* and *P. sele* are names which have been proposed by different authors for the same species," and suggests as a more appropriate name a new one of his own : *P. gelatinosus*. Mr. McClelland quotes a translation of the description of *Polynemus plebeius*, by M. M. Cuvier and Valenciennes, in which it is distinctly observed, that this species "has a very large swimming bladder, thin, and without appendages."

Yet Mr. McClelland, by way of illustrating the description of this species *without appendages to the air vessel*, has republished a copy of Buchanan's drawing of *P. sele* (l. c. Pl. VI.) the airvessel of which Mr. McClelland himself had previously (Journ. As. Soc. Vol. VIII. l. c.) described as presenting on either side about "*twenty-two tendinous attachments*." Thus, in a paper avowedly written to call attention to the airvessel (the isinglass) of one species, and to instruct the reader how to distinguish this species from others, not only are two species confounded, but the confusion is increased by publishing a description of a species, totally distinct from the one intended to be described, and by illustrating that description by means of a figure of another, different species.

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**POLYNEMUS SEXTARIUS, Bloch, Schneider.**

*Polynemus sextarius*, Bl. Schn. 18, Pl. 4.

*Polynemus sextarius*, Cuv. and Val. III. 388.

*Polynemus sextarius*, Bleeker, Berh. Batav. Gen. XXII. 59.

*Young.* Head above and back yellowish green, lighter on the sides; abdomen pale silvery; opercle silvery with a blackish spot; another black spot, nearer the back, between the head and the anterior dorsal; fin-membranes greyish white, minutely dotted with black towards their free margins; filaments white. Iris silvery, black towards the upper part.

D 8—1/12, C 17 $\frac{1}{2}$ , A 3/12, V 1/5, P 14, Filaments 6, Br. VII.

**HABIT.**—*Sea of Pinang.*

Tranquebar, Coromandel, Batavia.

**TOTAL LENGTH:** 4 inch.

The length of the head is  $\frac{1}{4}$  of the total measured from the snout to the centre of the posterior caudal margin. The orbit is oval obliquely situated: its greatest diameter, parallel to the upper jaw, is  $\frac{1}{3}$  of the length of the head. The ascending margin of the preopercle is finely toothed, the lowest tooth longer than the rest. The length of the third dorsal spine, the longest, is little less than the greatest vertical diameter of the body; the length of the second dorsal spine equals the extent of the base of the anterior dorsal fin. In height the fin itself slightly exceeds the posterior. The lateral line is nearly straight; from the root of the caudal it deviates a little downwards

proceeding to the posterior margin of the lower lobe. The filament nearest the pectoral is a little longer than the rest, its length nearly equalling that of the head; the other five are nearly equal. A solitary individual occurred at Pinang in 1843. As observed by M. M. Cuvier and Valenciennes, the airvessel is excessively small, pointed at both extremities, of the shape and size of a grain of oats.

**POLYNEMUS HEXANEMUS**, Cuv. and Val.

*Polynemus hexanemus*, Cuv. and Val. III. 389.

*Polynemus hexanemus*, Bleeker: Verh. Batav. Gen. XXII. 25, 59.

Head above and back yellowish green, abdomen pale silvery; fin-membranes pale yellow minutely dotted with black, particularly the pectoral fins which have a black appearance; filaments white. Iris silvery, dotted with black towards the upper orbital margin.

D 8—1/12, C 17 $\frac{1}{2}$ , A 3/11, V 1/5, P 13, Filaments 6, Br. VII.

**HABIT.**—*Sea of Pinang.*

Batavia, Samarang, Pasuruan.

**TOTAL LENGTH:** 4 inch.

The length of the head is  $\frac{1}{4}$  of the total, measured from the muzzle to the centre of the posterior caudal margin. The orbit is oval, situated as in *P. sextarius*: its greatest diameter is contained  $3\frac{1}{2}$  times in the length of the head, in consequence of which the eye appears comparatively smaller than in the preceding species. The ascending margin of the preopercle is finely toothed, the lowest tooth being stronger than the rest. The first dorsal spine is minute and almost hid by the scales. The length of the third and fourth dorsal spines, the longest, are but about  $\frac{2}{3}$  of the greatest vertical diameter of the body. The length of the second dorsal spine is a little less than the extent of the base of the anterior dorsal fin. In height the fin itself is somewhat less than the posterior, the reverse of which is the case in *P. sextarius*. At the root of the caudal fin the hitherto straight lateral line deviates a little downwards, and then again continues straight towards the centre of the margin. The scales of the body have a short raised line in the centre, producing series of continued lines parallel to the lateral. The second, third and fourth filaments from the pectoral fin, are the largest, greatly exceeding the length of the head, almost extending to the anal fin; the rest are nearly equal, somewhat shorter. From the description of M. M. Cuvier and Valenciennes,

founded upon a drawing by M. M. Kuhl and Van Hasselt, the present principally differs in the comparative shortness of the 2<sup>nd</sup>, 3<sup>d</sup>, and 4<sup>th</sup> pectoral filaments. Although not extending to the caudal fin, they are the longest, and thus retain the relative dimensions. As these organs are liable to individual variations in all the other species, there appears no reason to doubt the identity of the present and *P. hexanemus*. From *P. xanthonemus*, Cuv. and Val. the present differs in the lined scales, and in the length of the caudal lobes, being more than  $\frac{1}{2}$  of the total. A single individual was observed at Pinang in 1844.

**POLYNEMUS HEPTADACTYLUS, Cuv. and Val.**

*Polynemus heptadactylus*, Cuv. and Val. III, 390.

*Polynemus heptadactylus*, Bleeker: Verh. Batav. Gen. XXII. 25, 60.

Head above and back yellowish green; sides beneath the lateral line and abdomen pale silvery; fin-membranes pale yellow, minutely dotted with black, particularly the pectoral fins which have a black appearance; filaments white; the points of the four superior, nearest the pectorals, bright yellow. Iris silvery, blackish towards the upper margin of the orbit.

D 8—1/12, C  $17\frac{1}{8}$ , A 3/11, V 1/5, P 13, Filaments 7, Br. VII.

HABIT.—*Sea of Pinang.*

Batavia, Cheribon, Samarang.

TOTAL LENGTH: 4 $\frac{1}{2}$  inch.

In colours, general outline, and relative proportions this species so greatly resembles *P. hexanemus* that no difference can be assigned, but the additional seventh filament. The straight lateral line deviates slightly downwards at the root of the caudal; on the middle of the fin it divides in two parallel branches, which terminate in the centre of the posterior margin. The scales have a raised central line, forming series of continued lines, parallel to the lateral line. The two filaments nearest the pectoral fins and the seventh are equal, shorter than the other four which extend to the anal fin. The ascending margin of the preopercle is toothed as in *P. hexanemus*. According to M. M. Cuvier and Valenciennes the present in forms and colours so closely resembles the American species: *P. plumieri*, (Lacép),\* that they

\* *P. virginicus*, Linné?—*P. paradisæus*, Bloch.—*Polydactylus plumieri*, Lacép.—*P. americanus*, Cuv. and Val.

can assign no distinguishing characters.—Nevertheless, the two are specifically distinct. The American species is described as having a large, thin air-vessel, without appendages, and numerous small cœca. *P. keptadactylus* has but four rather large cœcopyloric appendages, and no airvessel. At Pinang it is of very rare occurrence. Of three individuals observed, none exceeded the length given.

GEN. MULLUS, Linné 1766.

SUB. GEN.—HYPENEUS, Cuvier, 1829.

Resembling *Mullus*, but with teeth in both jaws; some with velvety teeth on the palate and vomer; opercle generally terminating in a sharp point.

1. *With velvety teeth in both jaws, on the palate and vomer.*

HYPENEUS VITTATUS,\* (Forskål) VAR.?

*Young.* Head above and back pale bronze, with a whitish band above the lateral line, along which the ground colour appears like a bluish line; sides and abdomen pale silvery; a yellow longitudinal band from the posterior angle of the eye, at first beneath the lateral line, which it intersects a little in front of the caudal fin; a second paler yellow band from the pectoral to the root of the caudal; cheeks and opercles silvery; opercle with a pale crimson spot continued obliquely down the preopercle; a second smaller spot over the point of the opercle and the root of the pectoral; dorsals with two or three transversal blackish bands; caudal pale yellowish with a broad blackish margin; pectorals white; rays of anal, ventrals and the gular filaments pale yellow. Iris pale golden.

*Older.* Head above Indian red, continued on the back; cheeks and opercles silvery rose-coloured; caudal pale orange with a broad blackish margin. Iris golden crimson.

D 8—1/8, C 15½, A 1/6 or 7, V 1/5, P 15 or 16, Br. IV.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 5 inch.

\* *Mullus vittatus*, Forskål Fauna Arab. 31, No. 28.—*Mullus vittatus*, Linné: Syst. 1341.—Lacépède, III. Pl. 14, Fig. 1.—*Mullus barbatus*, Bloch-Schneider, 79.—Russell CLVIII. *Bandi Goolivinda*.—*Mullus bandi*, Shaw IV. 615.—*Mullus vittatus*, Shaw IV. 616, Pl. 89.—*Upeneus vittatus*, Cuv. and Val. III. 448.

M. M. Cuvier and Valenciennes count 7 spines in the anterior dorsal; Russell gives 8, and correctly figures the first as being very small. Single small individuals occur at Pinang at all seasons.

2. *With velvety teeth in both jaws; palate toothless.*

*HYPENEUS FLAVOLINEATUS*,\* (Lacépède) VAR.

Head above and back pale bluish brown or bronze; cheeks, sides and abdomen pale greenish silvery; from the lower part of the orbit a vertical crimson streak; opercle and the root of the pectorals crimson; on each side beneath the lateral line a broad longitudinal orange, or rust-coloured band, intersecting the lateral line at the commencement of the posterior dorsal, and terminating above it at the root of the caudal; fins pale yellow; dorsals and caudal each with three or four oblique waved reddish bands; lower part of anal and ventrals pale reddish; gular filaments yellow. Iris golden.

D 7 or 8—9, C 15 $\frac{1}{4}$ , A 7, V 1 $\frac{1}{5}$ , P 14 or 15, Br. IV.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 5 $\frac{1}{4}$  inch.

M. M. Cuvier and Valenciennes count 7—9 in the dorsal fins; in some individuals however, a very minute spine precedes the longest. Those observed at Pinang appear principally to differ from *H. flavolineatus* in having waved reddish bands on the dorsals and caudal fins. It must however be observed that these bands become totally obliterated shortly after death. The lateral band remains, but it changes to blackish. In other characters this fish agrees with the description of *H. flavolineatus*. The length of the head is contained 4 $\frac{1}{4}$  times in the total, measured to the centre of the caudal margin; the greatest vertical diameter of the body is 5 $\frac{1}{3}$  of the total; the eye occupies about the third fourth from the muzzle, its diameter equalling  $\frac{1}{4}$  of the length of the head. The distance between the two dorsals equals the extent of the base of the posterior, but is somewhat less than that of the anterior. The ramifications of the lateral line consist of 5 or 6 branches on each scale, of which three or four are directed obliquely upwards, one downwards. The root of the scales has four or five crenulations. The filaments are rather thick, fleshy, slightly exceeding

\* *Mullus flavolineatus*, Lacépède III. 406.—*Mullus aureo-vittatus*, Shaw IV. 618.—*Upeneus flavolineatus*, Cuvier and Valenciennes III. 456.



the commissure of the gill-openings. Single individuals occur at all seasons at Pinang.

### FAM. CATAPHRACTOIDÆ.

GEN. *PLATYCEPHALUS*, (Bloch, Schneider 1801) *Cuv. and Val.*

Head much depressed with trenchant edges, armed with spines, body covered with scales; ventral fins five-rayed, widely separated from each other, owing to the lengthened and flattened shape of the pelvic bones; palate with sharp teeth; branchiostegous rays 7.

*PLATYCEPHALUS INSIDIATOR* (Forskål).

*Cottus insidiator* Forskål, Fauna Arab, 25, No. 8.

*Cottus insidiator*, Linné: Syst. 1213.

*Callionymus indicus*, Linné: Syst. 1153.

*Cottus spatula*, Bloch, Pl. 224.

*Batrachus indicus*, Bloch: 43.

*Callionymus indicus*, Bloch, 59.

*Calliomorus indicus*, Lacépède II. 344.

*Cotte madécasse*, Lacépède, III. 248, Pl. 11, Fig. 1, 2.

*Platycephalus spatula*, Bloch-Schneider, 59.

Russell XLVI. Irrwa.

*Cottus insidiator*, Shaw IV. 260.

*Cottus madagascariensis*, Shaw IV. 261, Pl. 37.

*Colliomorus chacca*, Buch. Ham. 133, 373.

*Platycephalus insidiator*, Cuvier and Val. IV. 227.

(Icon) *Platycephalus chacca*, Gray: Ill. Ind. Zool. II. Pl. 93, Fig. 2.

*Platycephalus insidiator*, Temm. Schl. Fauna Japon. Pisc. 39, Pl.

XV. Fig. 1.

*Platycephalus insidiator*, Richardson Rep. 1845, 216.

*Platycephalus insidiator*, Bleeker, Verh. Batav. Gen. XXII. 6.

Head above and back greenish or brownish grey with a few smaller and larger dark brown scattered spots; sides, from a little below the lateral line, and abdomen white; fin membrane of the caudal white, orange or yellow at the base and along the rays; the base indistinctly spotted with brown; the upper and lower angle black, between both three longitudinal, somewhat oblique black bands, liable to individual variations, the membranes of the other fins whitish, transparent; the dorsal, ventral and pectoral rays more or less distinctly annulated with

brown. Iris pale golden green ; pupil black, heart-shaped by a pointed lobe descending from the upper margin of the iris.

D 1—8—1—13, C 15 $\frac{3}{4}$ , A 13, V 1/5, P. 18 or 19, Br. VII.

HABIT.—*Sea of Pinang.*

Sea of Madagascar, Red Sea, Moluccas, Seas of China and Japan, Batavia, Bay of Bengal, estuaries of the Ganges.

TOTAL LENGTH : 1 ft. 6 inch.

M. M. Cuvier and Valenciennes count 8 spines in the anterior dorsal fin ; at a short distance, however, in front of the first of these eight, is a very small isolated reclining spine, and in the space between the eighth spine, and the first ray of the posterior dorsal, slightly nearer the latter than it is the former, is another very minute isolated reclining spine, which thus make the whole number of spines 10 instead of 8. The first and the tenth spines are so minute, and in the living fish so hid in the scales, that they easily escape notice. Russell, indeed, in Pl. XLVI. correctly gives the tenth spine, and his description counts 9—13 in the dorsal fins.

This as well as the following species of *Platycephalus* is occasionally taken in the fishing stakes placed along the coasts ; they are all capable of sustaining life some little time out of water. They are eaten by the natives.

*PLATYCEPHALUS CLAVULATUS*, Cantor.

(*Young?*)—Head above, opercles, back and sides pale reddish brown ; beneath and behind the posterior dorsal fin some large patches of a lighter brown ; along the anterior half of the back some distant brown dots ; along the lateral line a more regular series of distant brown dots ; abdomen and sides, from a little below the lateral line, white ; from behind the ventral fins minutely dotted with brown ; cheeks whitish, minutely dotted with brown, and with two short vertical brown streaks beneath the orbit ; membrane of anterior dorsal minutely dotted with brown ; the upper half so closely so, as to acquire a blackish appearance ; posterior dorsal whitish, each ray with one or two brown dots at the upper part ; caudal membrane whitish, minutely dotted with brown ; at the root an indistinct semicircular brown band, near the margin some irregular brown spots, which near the lower part are confluent, forming an oblique band ; anal whitish ; ventrals and pectorals minutely and so closely dotted with brown, as to have a

blackish appearance; the upper six or seven pectoral rays white, annulated with brown, the 19<sup>th</sup> and 20<sup>th</sup> ray, white. Iris pale greenish golden, minutely dotted with brown; pupil heart-shaped.

D 8—11, C. 15 $\frac{1}{2}$ , A 11, V  $1\frac{1}{5}$ , P 20, Br. VII.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 5 $\frac{1}{2}$  inch.

The length of the head is contained nearly 3 $\frac{1}{2}$  times in the total; the eye occupies the second fourth part from the muzzle; the distance between both eyes is less than one half of the vertical diameter of the eye. The nasal bone is rough, but without spines. At the commencement of the supraorbital crest is a reclining spine, on the posterior half three smaller, and on its continuation along the sides of the occiput are two distant spines; from the orbit along the upper margins of the opercles proceed 5 small gradually backwards increasing spines; the opercle has two backwards diverging linear crests without spines. On the middle of the anterior infraorbital bone is a small reclining spine; on the posterior two distant larger, from whence proceeds a raised linear crest, terminating in the upper angular spine of the preopercle. The latter spine extends to the margin of the opercle, its length exceeding three times that of the smaller, lower spine. The angle of the mouth is situated opposite the anterior angle of the orbit. The dentition resembles that of *Platycephalus insidiator*: the upper maxillary velvety teeth form a very narrow band, which is considerably widened on the intermaxillary bones, where the posterior series has on each side three teeth longer than the rest. The lateral line is nearly straight, less approaching the back than in *P. insidiator*; at its commencement, as far as the middle of the anterior dorsal, every other scale has a minute reclining spine; the rest of the lateral line, though raised and distinct, appears to be spineless. The present species of which a single, apparently young, individual was observed at Pinang in 1843, appears to be closely allied to *Platycephalus scaber*, (Linné).

**PLATYCEPHALUS CARBUNCULUS, Cuv. and Val.**

*Platycephalus carbunculus*, Cuv. and Val. IX. 461.

Ground colour greenish buff; head, cheeks, back and sides spotted with blackish brown, forming three short vertical bands on the sides of the head beneath the orbit, and three larger irregular bands on the

sides of the body; throat and abdomen white; anterior dorsal fin white, upper half pale blackish, marbled with white veins; posterior dorsal, caudal, ventrals and pectorals white; the rays annulated with pale black; posterior half of caudal pale blackish with two or three waved vertical white lines; anal white, each ray with one or two brown dots near the extremity. Iris pale greenish golden, spotted with brown; pupil black, heart-shaped.

D 9—11 or 12, C 11½, A 12, V 1/5, P. 19, Br. VII.

HABIT.—*Sea and estuaries of Pinang.*

Bombay.

TOTAL LENGTH: 6½ inch.

The length of the head is  $\frac{1}{2}$  of the distance from the muzzle to the root of the caudal; the latter is  $\frac{1}{2}$  of that distance. The breadth of the head in front of the eyes exceeds by  $\frac{1}{2}$  the distance from the muzzle to the anterior part of the orbit. The raised supraorbital crest is strongly serrated, leaving the upper part of the skull like a narrow furrow, the breadth of which is scarcely  $\frac{1}{2}$  of the vertical diameter of the eye. The upper maxillary teeth form a much broader band than in either *P. insidiator* or *P. clavulatus*, and it is but little widened on the intermaxillary bones, on which the teeth are of uniform length, velvety like the rest. The number of spines of the head renders this species conspicuous. It occurs, although not numerously, at all seasons at Pinang, and it is eaten by the natives.

GEN. SCORPÆNA, (*Artedi*) Linné 1748.

Head large, spinous, filamentous, scaleless, compressed; eyes placed near each other; teeth in the jaws, vomer, and palate; dorsal fin single, anterior part spinous; branchiostegous rays seven.

SCORPÆNA PICTA, Kuhl and Van Hasselt.

*Scorpena picta*, Cuv. and Val. IV. 321.

*Scorpena picta*, Bleeker: Verh. Batav. Gen. XXII. 4.

Head greenish olive, largely spotted with black, radiating round the orbit; ground colour of body and fins pale greenish or brownish buff, on the back and sides above the lateral line largely and irregularly marbled with black, which beneath the anterior part of the soft dorsal is continued vertically towards the abdomen; the latter and the rest of the sides irregularly spotted with brownish black; spines and fin rays, except the ventral, greenish buff, annulated with brownish black;

membranes of dorsal, caudal and anal fins greenish buff; the spiny part of the dorsal largely washed with black, the rest with a broad vertical blackish spot, continued over the body, and with two smaller at the posterior margin; caudal with a vertical blackish band at the root, a second in the middle, a third at the margin; membrane of pectorals blackish brown; of anal with a black spot behind the root of the second spine, and an irregular blackish transversal band across the middle, with black spots on the margin; ventrals uniformly blackish brown. Filaments of the body black with slate grey points; the two large supraorbital ones olive, largely spotted with black. Iris golden dark olive with five broad radiating black streaks.

D 12/10, C 13 $\frac{3}{5}$ , A 3 $\frac{5}{5}$ , V 1 $\frac{5}{5}$ , P 17, Br. VII.

HABIT.—*Sea of Pinang.*

Java, Celebes.

TOTAL LENGTH: 7 inch.

The length of the head is a little less than  $\frac{1}{3}$  of the total; the eye occupies the second fourth from the muzzle; the angle of the mouth is situated a little in front of the eye, opposite the lowest of the anterior infraorbital spines, which latter is arched downwards, but has its point directed forwards like the two larger ones. Of the three supraorbital spines the central is the strongest: behind it appears a fleshy pointed filament, in length equalling the diameter of the orbit.

Smaller filaments are scattered over the body, and a series appears above the lateral line. The second anal spine is the strongest of all, its length equalling that of the anal fin, which is  $\frac{1}{4}$  of the total length. The band of velvety teeth in the upper jaw is narrowed towards the intermaxillary bones. The reverse is the case in the lower jaw, where the band of teeth is considerably widened on the symphysis. The innermost of the lower maxillary teeth are longer than the rest. The present offers the specific characters of *S. picta* in having the lowest of the anterior infraorbital spines directed forwards, and the second anal spine excessively large; but it differs in presenting a long filament above each eye, which did not exist in the specimen described by M. M. Cuvier and Valenciennes. A single individual occurred at Pinang in 1842.

GEN. PTEROIS, Cuvier, 1819.

Differs from *Scorpena* in the absence of palatal teeth, and in having the dorsal spines and pectoral rays excessively elongated.

**PTEROIS MILES, (Bennett.)****Scorpena miles, Bennett : Ceylon, Pl. 9.****Pterois muricata, Cuv. and Val.\* IV. 363.****Macrochyrus† miles, Swainson II. 264.**

**Adult.** Ground colour of head and body, impure rose- or flesh-colour, the scales edged with lighter or darker reddish brown, so as to produce a net-work ; sides of the head and body with oblique and vertical scarlet bands, the number and breadth varying individually : across the hindhead two or three such, and between the eyes a longitudinal scarlet band ; behind the point of the opercle a triangular black spot ; lips, throat and abdomen reddish white ; dorsal spines scarlet, broadly annulated with black, or white ; their membrane scarlet, in some with the pointed portion attached to each spine, black, or with a triangular black spot near the base ; dorsal, caudal and anal rays and membranes scarlet ; anal spines scarlet, their membrane reddish black ; pectoral rays scarlet, more or less annulated with black ; base of the pectoral scarlet, continued over the root in the shape of three oblique bands ; membrane brownish green or bronze, with a black streak along each ray ; ventral spine alternately white and scarlet ; membrane pale blackish green, with longitudinal series of black and milky spots between and across the rays ; posterior half of the membrane black ; a scarlet spot inside the root of each pectoral. Supraorbital fleshy filaments black ; those of the upper jaw and preopercle white with scarlet points. Iris silvery white, with four or five scarlet or reddish black radiating bars.

**Young.** Colours distributed as in the adult ; the scarlet paler ; pectoral fins uniformly greenish black.

D 13/11, C 14½, A 3/7, V 1/5, P 12 or 13, Br. VII.

\* Although this Vol. bears 1829 on the title-page, the description quotes *S. miles*, Bennett, in *Fishes of Ceylon*, the first edition of which appeared in 1839. However this may be, M. M. Cuvier and Valenciennes in quoting Bennett, admit the priority of his description and figure, and his specific denomination must therefore be retained.

† *Macrochyrus*, Swainson, founded on *Scorpena miles*, Bennett, is characterised as having "the pectoral fins only one-third as long as the body, and the mouth subvertical." Both characters however, are incorrect ; the pectorals in every stage of growth much exceed one-third of the body (total length ?), and the mouth opens obliquely as in *Pterois*.

HABIT.—*Sea of Pinang.*

Ceylon, Red Sea, Bourbon.

TOTAL LENGTH,  $9\frac{3}{4}$  inch.

The length of the head is  $\frac{1}{4}$  of the total, equalling that of the caudal fin; the eye occupies the third fourth from the muzzle. Besides the nasal spine, there are two or three supraorbital ones, of which the posterior is the largest; behind it proceeds the spiny temporal ridge obliquely downwards to the commencement of the lateral line, which has one or two spines. On each side of the occiput appears a very broad spine, sharp like a knifeblade, with two points. The ridge of the infraorbital bones is spiny, proceeding obliquely over the cheek towards the margin of the preopercle, from which rise three spines. The surface beneath the infraorbital ridge is uneven to the touch, but without spines. The interval between the orbits is broad, equalling the transverse diameter of the eye. From the central supraorbital spine rises a pointed fleshy filament, which in the young equals one-half of the vertical diameter of the eye; but in the adult it is much shorter, or absent. The most constant of the other filaments is one on the upper jaw near the angle of the mouth, and the largest are two or three on the lower margin of the preopercle. The membrane of the three or four upper pectoral rays has a very deep incision, so as to give each ray a feather-like appearance, and the points of the lowest four or five rays are free, projecting beyond the membrane. The length of the pectoral fin varies not only according to age, but also individually. In a young one the point of this fin reaches to the middle of the caudal, its length being about  $\frac{2}{3}$  of the total. In one of two adults of equal length,  $9\frac{3}{4}$  inches, the pectoral measures  $3\frac{7}{8}$  inches, in the other  $4\frac{1}{2}$  inches. In the fish as commonly seen, but a small portion of the base of the dorsal spines is connected by the membrane. In such, however, as have been examined alive, the instant they are taken out of the sea, the membrane is found continued along the posterior margin of each spine till near the point, where an elongated long flap appears, like the pendant of a lance. Out of the element the scarlet colour of the fish soon fades to a deep rose-colour, which then makes the vertical stripes, on which the brown net-work appears, more conspicuous. The fish appears to be a heavy swimmer, and as observed by Bennett, it never attempts to support itself in the air. At Pinang single individuals occur at all

seasons. It is a very bony fish, and the flesh is said to be insipid. It preys on small *Crustacea*.

GEN. PROSOPODASYE,\* *Cantor*.

(Equivalent to *APISTUS*, Cuvier.)

Differs from *Scorpaena* in having fewer pectoral rays and all branched, a long moveable spine on the infraorbital bone, and a similar one on the preopercle.

PROSOPODASYE TRACHINOIDES, (Cuv. and Val.)

*Apistus trachinoides*, Cuv. and Val. IV. 401, Pl. 92. Fig. 1.

*Trichosomus trachinoides*, Swainson, Nat. Hist. Fish. II. 265.†

*Apistus trachinoides*, Richardson, Rep. 1845, 213.

*Apistus trachinoides*, Richardson, Voy. Samarang, Fishes, Pl. III.

Fig. 3—5.

*Apistus trachinoides*, Bleeker, Verh. Bat. Gen. XXII. 8.

Head above and back blackish brown; sides and abdomen pale neutral tint; membrane of the dorsal fin pale bluish grey with four large oblique blackish bands, between which some oblique pale brownish lines; anal and ventrals pale-bluish grey, the former with larger oblique black bands, between which some pale brownish oblique lines; the posterior half of the latter blackish; caudal yellowish white, minutely dotted with brown and with a black vertical band at the root, and one or two vertical series of black spots near the posterior margin; pectorals pale neutral tint largely spotted with blackish brown. Iris golden flesh-colour, minutely dotted with black.

D 14 or 15/5, C 12½, A 3/4, V 1/5, P 12, 13 or 14, Br. VI.

HABIT.—*Sea and estuaries of Pinang, Singapore.*

Java, Madura, Sea of China.

TOTAL LENGTH, 3½ inch.

The fish is numerous at all seasons. It is capable of living a considerable time out of its element. It is applied as manure, but not eaten.

\* *Πρόσωρον*, maak; *Saeds*, rough. Substituted for *Apistus* Cuvier, 1829, preoccupied by *Apistia* (Scr. *Apistus*.) Hübner 1816 (*Lepidopt.*)

† *Trichosomus*, in itself inadmissible, is not equivalent to *Apistus*, Cuv.



## GEN. CORYTHOBATUS,\* Cantor.

(Equivalent to MINOUS. Cuv. and Val.)

Differs principally from *Prosopodasys* (*Apistus*.) by the absence of scales, and of teeth on the palatal bones.†

## CORYTHOBATUS WOORA, (Cuv. and Val.)

Russell CLX. Worrah Minoo A.

*Apistus minous*, Cuv. R. A. II. 168<sup>(3)</sup>

*Minous woora*, Cuv. and Val. IV. 421.

*Apistes russellii*, Swainson, II. 265.

*Minous woora*, Richardson, Rep. 1845, 213.

Head above and back brownish grey, or pale silvery grey; sides and abdomen buff or bluish white; dorsal fin buff, the margin of the spiny portion, and the upper half of the soft portion black; caudal pale yellowish white, with a vertical blackish band at the root; a second in the middle, and a third near the margin; anal and ventrals buff, their external half black; pectorals buff at the root, the rest black; the free ray white, more or less distinctly annulated with black; body and fins minutely dotted with black; filaments of lower jaw white. Iris silvery grey, minutely dotted with black.

D 9 or 10/10 or 11, C 11½, A 1/9, V 1/5, P 10 or 11—1, Br. VII.

HABIT.—*Sea and estuaries of Pinang, Malayan Peninsula.*

Iale of France, China Seas, Vizagapatam.

TOTAL LENGTH, 3½ inch.

M. M. Cuvier and Valenciennes count 11/12 in the dorsal, Sir J. Richardson 10/11. (China Spec.) At Pinang the species is numerous, and applied as manure.

## CORYTHOBATUS ECHINATUS, Cantor.

## Plate XIII.

Ground colour of head and body umber, pale on the sides and abdomen; fins of a darker brown than the body; on the opercles, above the lateral line and close to the anal fin some larger and smaller irregular light spots, edged with black; numerous similar small round

\* *Képus* helmet; *βάρος* thorny. Substituted for *Minous*, Cuvier and Valenciennes 1829, pre-occupied by *Minois*, Hübner 1816 (*Leptidopt.*)

† *Minous woora*, and *M. monodactylus*, the two only species described by Cuvier and Valenciennes, and *M. adamsii*, Richardson: Voy. Samar. Fishes, 7, Pl. II. Fig. 4—5, have a free undivided ray beneath the pectoral fins, but *Corythobatus echinatus* has no such free ray.

spots on the fins ; on the caudal three large such bordering the margin ; from the root of the pectoral to the gill-opening two rose-coloured irregular bands edged with black ; a similar angular spot behind the eye, and some similar bars radiating over the iris ; the latter with a narrow golden circle round the pupil.

D 13/11, C 11 $\frac{1}{2}$ , A 2/8, V 1/5, P 11, Br. VI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH, 3 $\frac{1}{4}$  inch.

The form of the body is broad lanceolate, with the sides highly compressed. The profile of the forehead ascends nearly vertically, from thence the back forms an arch ascending to the sixth dorsal spine, when it gradually descends towards the tail ; the profile of the abdomen is a little less arched than the back. The length of the head is  $3\frac{1}{3}$  of the total. The eye is placed high on the head ; the vertical diameter of the orbit, slightly exceeding the horizontal, is  $\frac{1}{2}$  of the length of the head ; the distance of the orbit from the back, or the root of the anterior dorsal spine is  $\frac{1}{2}$  of the diameter of the orbit. The anterior, moveable, infraorbital bone carries two blunt spines of which the superior, the longer, scarcely projects beyond the middle of the orbit : both are directed backwards and downwards. The posterior infraorbital is immoveable, and has but two very minute spines. The rounded preopercle carries four distant, flattened spines : the two lower ones are very minute, the two upper hardly extend beyond the anterior third of the opercle. The opercle terminates above in a flat membranous point, below which appear two oblique long ridges. There appears to be but a single nasal opening which is a small tube, situated in front of the lower part of the eye. The small oblique mouth scarcely reaches the level of the anterior orbital margin. The velvety teeth (Pl. XIII. Fig. 2,) are placed in both jaws on a crescent-shaped band ; that of the upper is divided under the symphysis by a naked linear interval, behind which appears a minute fleshy tubercle. On the vomer appears a small crescent of velvety teeth. But the palatals are toothless. The tongue resembles that organ of *Prosopodasys trachinoides* and *Corythobatus woora* : it is moveable, fleshy, rounded, and occupies nearly the whole cavity. The greatest vertical diameter, at the root of the pectoral, equals the length of the head, the greatest thickness is  $2\frac{1}{3}$  of the former diameter. The dorsal

fin occupies the whole length of the back. The anterior spine rises between the anterior orbital margins: it is the longest and strongest of all, its length being about  $\frac{2}{3}$  of that of the head. The succeeding spines and rays gradually decrease to the seventh ray, which is about  $\frac{2}{3}$  of the length of the head. The remaining rays abruptly decrease; the eleventh, being but  $\frac{1}{3}$  of the length of the head, is attached to the tail by a continuation of the dorsal membrane. All the finrays are undivided, but jointed. The caudal is subrhomboidal or rounded, the longest, central, rays are a little shorter than the head. The extent of the anal fin slightly exceeds  $\frac{1}{3}$  of the dorsal; the two spines and the seventh and eighth ray are a little shorter than the intervening rays, which are  $\frac{1}{3}$  of the length of the head. The lower half of the eighth anal ray is attached to the tail by a very short continuation of the finmembrane. The anus is situated a little in front of the fin. The pectorals are elongated, rhomboidal, the central rays equaling the length of the head. The anterior ventral ray, the longest, slightly exceeds  $\frac{1}{3}$  of the length of the head; the fifth is attached to the abdomen by a continuation of the finmembrane. The lateral line is a series of linear tubes, nearly following the outline of the back on the upper third of the side. The fish appears to be without scales, but it is studded with small tubercles, each surmounted by a minute, backward directed spine. The tubercles may be seen by the naked eye, but their spines may be perceived by passing a finger from the tail forward. On the back, the sides of the head and body the tubercles are fewer, more distant than on the throat and abdomen, where they are crowded. The axilla and the space covered by the pectorals is naked.

A solitary individual occurred at Pinang in July 1842.

GEN SYNANCIA, *Bloch Schneider* 1801.

Differs from *Pelor* by the want of teeth on the palate and vomer, and of free rays beneath the pectoral fins.

SYNANCIA ELONGATA, Cuv. and Val.

*Synancia elongata*, Cuv. and Val. IV. 456.

*Trachicephalus elongatus*, Swainson II. 268.

*Synancia elongata*, Bleeker: Verh. Batav. Gen. XXII. 10.

Head, back and sides bluish brown or neutral tint, paler on the abdomen and with rose coloured lustre, everywhere minutely dotted with black, and with scattered round white spots, and white warty filaments;

dorsal, caudal, anal and pectoral fins neutral tint, largely marbled with black, and with numerous white spots; ventrals neutral tint, posterior half black; points of all the rays white. Iris pale golden, dotted with black and with radiating black bars.

D 10 or 11/14 or 15, C 12½, A 2/13 or 14, V 1/5, P 14 or 15, Br VII.

HABIT.—*Sea of Pinang.*

Java, Pondicherry.

TOTAL LENGTH: 4½ inch.

M. M. Cuvier and Valenciennes count 9/15 in the dorsal fin. The length of the head is about ¼ of the total; the eye occupies the second fourth from the muzzle. On the lateral line appears a series of distant filaments, of which the anterior four are long, the rest fleshy, all with the apex divided in two. The anterior half of the line proceeds from the angle of the opercle obliquely upwards, the posterior half follows the back till the root of the caudal, where it bends obliquely downwards to the centre of the fin, terminating horizontally near the margin. This species is numerous at Pinang where, if used at all, it is with other offal applied as manure. It is capable of living a considerable time out of water.

#### FAM. SPAROIDÆ.

GEN. CHRYSOPHRYs, Cuvier, 1829.

Rounded molars on the sides of the jaws, disposed in the upper jaw in at least three series; in front some conical or blunt teeth; branchiostegous rays six.

CHRYSOPHRYs CALAMARA, Cuv. and Val.

Russell XCII. Calamara.

Chrysophrys calamara, Cuv. and Val. VI. 117.

Head above blackish brown, the rest of the body silvery grey, the scales minutely dotted and edged with brown; spines, rays and fin membranes grey, minutely dotted with brown, which gives the anal and ventral membranes a blackish brown appearance. Iris silvery, minutely dotted with brown, the upper margin black.

D 11/10 or 11, C 19½, A 3/9, V 1/5 P 15, Br. VI.

HABIT.—*Sea of Pinang.*

Java, Madras, Vizagapatam, Malabar.

TOTAL LENGTH: 10 inch.

When the upper jaw is protracted the length of the head is  $\frac{1}{3}$  of that of the body, the caudal fin not included; the eye borders on the profile, and occupies the centre between the protracted muzzle and the membranous point of the opercle; its diameter is little less than  $\frac{1}{3}$  of the length of the head. The second anal spine is the largest of all, its length equalling the distance from the protracted muzzle to the posterior margin of the orbit. The ventral spine equals the length of the fourth dorsal; the first soft ray terminates in a short filament. The pectoral fins when at rest, are slightly falcated, the fifth ray, the longest, reaching to the second anal spine.

At Pinang this fish appears to be an occasional visitor, a few individuals occurring together at irregular intervals, and they rarely exceed 7 inches in length. The flavour is said to be good.

GEN. PENTAPODUS, Cuvier, 1829.

With three elongated pointed scales, of which one above the root of each ventral, and a single between these fins, appearing like five ventrals, or feet; mouth little cleft; body rounded, with rather hard scales, advancing farther in front than in *Dentex*. In each jaw two canines, between which sometimes two or four smaller; the rest of the teeth velvety, disposed in narrow bands.

PENTAPODUS NUBILUS, Cantor.

Head above and back light reddish brown, paler on the sides; cheeks gill-covers and abdomen silvery white; an indistinct blackish oblique band from the nape of the neck to the point of the opercle; a second similar in front of the dorsal, terminating beneath the lateral line in a large rounded spot; a few indistinct blackish clouded spots along the sides; the scales of the body indistinctly edged with brownish and minutely dotted with brown; dorsal caudal and anal pale yellowish; pectorals and ventrals white, the posterior half of the latter pale blackish; the fin-membranes minutely dotted with brown. Iris pale golden. A number of minute pores on the infraorbital bones, the cheeks, the margin of the preopercle and on the lower jaw.

D 10/9, C 17 $\frac{1}{2}$ , A 3/8, V 1/5, P 13, Br. VI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH, 4 $\frac{1}{2}$  inch.

The head is elongated, the profile much sloping, its length, when the muzzle is protracted, is  $\frac{1}{3}$  of that of the body, the tail not included.

The eye is situated behind the centre of a line drawn from the protracted muzzle to the point of the opercle; its diameter is a little less than  $\frac{1}{3}$  of the length of the head. The canines of both jaws are very small; there are 4 in the upper, 6 in the lower of which the two outer ones are the largest and slightly outwards arched. The pores are very minute, scarcely perceptible by the naked eye, rather closely distributed over the infraorbitals, the cheeks, the margin of the preopercle and the lower jaw. The lateral line is very distinct, following the outline of the back. The scales are very finely ciliated: there are about 47 on a straight line. This species is closely allied to *P. porosus*, Cuv. and Val. from which it differs in the eye being situated farther back, in the comparatively longer pectoral fins, the second and third upper rays reaching the anal spine, and in the comparative greater length of the anal spines. The anterior of the latter is half the length of the second and third, which are equal and of nearly the same length as the succeeding soft rays. The description is taken from a solitary individual, observed at Pinang in 1844.

GEN. SPONDYLIOSOMA,\* *Cantor*.

(Equivalent to *CANTHARUS*, *Cuvier*.)

Teeth card-like, close, the external series a little stronger than the rest and slightly curved; mouth slightly cleft, not protractile.

SPONDYLIOSOMA GULIMINDA, (Cuv. and Val.)

Russell CVII. Lama Guliminda.

*Cantharus guliminda*, Cuv. and Val. VI. 344.

*Young*.—Head above, back and sides above the lateral line rose-coloured; the latter bordered beneath by a pale blue line; sides and abdomen silvery with five parallel straight longitudinal lines, each rose-coloured, bordered beneath with pale blue; cheeks and opercles silvery, washed with rose colour; beneath the orbit an elongated blue spot; a larger one on the opercle. Dorsal fin whitish transparent, either pale blue at the base, or with a bluish line behind each spine; the spiny part edged with vermilion; anterior half of caudal bluish, posterior pale crimson; the other fins whitish transparent; the anal membrane is some bluish near the margin.

\* *Σπονδύλιον* spindle; *σῶμα*, body. Substituted for *Cantharus*, *Cuvier*, 1829. pre-occupied by *Cantharus*, *Montfort*, 1808, (*Polypi*.)

*Adult*.—Head above and back vermillion; ground-colour of the upper half of the sides greenish grey, of the lower and of abdomen silvery; from the occiput a golden longitudinal band bordering the back; the lateral line bordered above by a crimson, beneath by a golden band; the scales at the origin of the lateral line broadly edged with crimson, forming a large rounded spot, from which proceeds a straight longitudinal crimson band, bordered beneath by a narrower golden band, beneath which four similar parallel bands, gradually lengthening and becoming paler towards abdomen. Infraorbitals silvery crimson, cheeks and opercle silvery, posterior half of opercle crimson; preopercle violet silvery; caudal rose-coloured; the other fins transparent white; dorsal edged with vermillion. Iris golden, upper margin bluish black.

D 10/9, C 17½, A 3/7, V 1/5, P 17, Br. V.

HABIT.—*Sea of Pinang.*

Madras, Vizagapatam.

TOTAL LENGTH: 6 inch.

The head is  $\frac{1}{4}$  of the total length to the centre of the posterior margin of the caudal; the greatest vertical diameter of the body equals the length of the head; the horizontal diameter of the eye is  $\frac{1}{4}$  of the latter; the eye occupies the second third. The ascending margin of the preopercle is finely toothed, the angle rounded; on its outer surface as well as on the infraorbitals appear some distant minute pores. The upper lobe of the caudal is longer than the lower, and the third upper ray terminates in a not very long filament, which is also the case with the first ventral ray.

The following errors occur in Russell's figure. The first dorsal spine is too short, its length in the fish is  $\frac{3}{4}$  of the second. The pectoral is also too short, its length being equal to that of the head; the dorsal rays likewise: their length slightly exceeds that of the spines. The anal fin is erroneously represented with one spine: it has three, the first of which is  $\frac{1}{4}$  of the second, which is but little shorter than the third. The ventral spine is one half the length of the head and equals the 10<sup>th</sup> dorsal, which slightly exceeds the preceding. All the spines are very slender and flexible. Single, mostly young individuals occur, but rarely, at Pinang.

GEN. CRENIDENS, *Cuvier and Valenciennes*, 1830.

The jaws with crenulated teeth, behind which others globular.

## SUB. GEN. GIRELLA,\* (Gray,) Richardson.

Teeth curved, flat and expanding towards their ends which are tricuspid, standing out in three rows on the margin of the jaw; a little way behind them a brush-like band of much smaller teeth which are also tricuspid and like the others, except in size.

CRENIDENS SARISSOPHORUS, Cantor.

Pl. I. Figs. 1-4.

*Young*.—Head, back and sides above the lateral line pale umber brown; rest of the sides and abdomen silvery buff; all the scales broadly edged with pale umber; spines buff, minutely dotted with dark brown; fin-membranes and rays buff, so closely dotted with dark brown, as to appear a shade darker than the body. Iris pale golden, orbital margin blackish.

D 11/15, C 15 $\frac{1}{2}$ , A 3/14, V 1/5, P 19, Br. V.

HABIT.—*Sea of Pinang, Malayan Peninsula.*

TOTAL LENGTH: 7 $\frac{1}{2}$  inch.

The form is elongated oval; the abdominal profile a little less arched than the dorsal. The vertical diameter at occiput is  $\frac{1}{2}$ , at the fifth dorsal spine 2 $\frac{1}{2}$ , between the last dorsal and anal rays  $\frac{1}{3}$  of the total length. The body is much compressed, particularly towards the back; the greatest thickness is at the lower third of the vertical diameter, where it equals  $\frac{1}{2}$  the length of the head. The muzzle is obtuse; the forehead a little arched between the eyes; the length of the head is  $\frac{1}{2}$  of the total; the eye is placed high up, its horizontal diameter is about 3 $\frac{1}{2}$  of the length of the head; the distance from the muzzle equals the diameter. The posterior opening of the nostril is an almost vertical fissure immediately in front of the eye; the anterior is oval and situated a little behind the muzzle; the infraorbital bone is very large, occupying nearly the upper half of the cheek, it is tumid and of an elongated, nearly oval shape; the preopercle is narrow and obscurely ridged, with a single minute spine at the angle; the opercle terminates in two widely separated flat points; the subopercle and interopercle are small. The scales of the head are very small, those of the cheek less indistinct than on the other parts of the head. The mouth is

\* Founded upon *Crenidens punctatus*, Richardson, (Report 1845, 242,) of which a figure appears in *Ill. Ind. Zool.* under the name of *Girella punctata*.



small, both jaws of equal length; their teeth are curved, flat, widening towards the three cusps, of which the centre one is a little larger than the lateral ones; the outer series consists of about 18 teeth gradually increasing in length towards the angle of the mouth (Fig. 2;) immediately behind, and in close contact with the outer, appears a second series of similar teeth; at a little distance behind these two series are two others also consisting of tricuspid teeth, but much smaller and almost setaceous (Fig. 3;) at the angle of the mouth the teeth of all four series coalesce, and have no interval between them. The gill-opening is small linear, and the five branchiostegous rays are completely hid in the membrane; the suprascapular bone is naked. The body is covered with scales of different sizes; the largest are those of the sides, from immediately beneath the lateral line as far as the pectorals extend, they appear bony and tumid; the posterior rounded margin carries upwards of 40 minute spines; their vertical diameter, nearly double the length of the horizontal, is about  $\frac{1}{2}$  of the diameter of the eye. From the apex of the pectorals the scales gradually decrease in size towards the caudal. The scales above the lateral line and those of the abdomen are much smaller than the rest; all are placed in irregular series, so that their number cannot be counted. The lateral line is a little below the upper fourth of the side; it consists of minute single tubes and follows the profile of the back towards the tail, in the middle of which it proceeds straight to the root of the caudal. The anterior dorsal spine, about  $\frac{1}{2}$  of the diameter of the eye, is situated at the anterior third of the total length; it is immoveable, placed horizontally, has no membrane and becomes more or less hidden by age; the second spine is the shortest of all, about  $\frac{1}{4}$  of the diameter of the eye; the third is  $\frac{3}{4}$ , the fourth exceeds by  $\frac{1}{4}$  the diameter of the eye; the fifth is excessively long, robust and appears to be composed of two parts; the lower half, when reposing, covers with its grooved posterior margin the sixth spine; the upper half overlaps the succeeding five spines; the length of the fifth is  $\frac{3}{4}$  of the greatest vertical diameter of the body, from the root of this spine. The rest of the spines gradually decrease in length towards the tenth, which equals the diameter of the eye; the eleventh exceeds it by  $\frac{1}{4}$  and is closely attached to the anterior dorsal ray. The first four dorsal rays are the longest, of equal length,  $\frac{2}{3}$  of the head; the rest gradually decrease, the fifteenth,

double one, being  $\frac{1}{3}$  of the first. The caudal is almost truncated, the central rays being but a little shorter than the rest, which are  $\frac{2}{3}$  of the length of the head. The anal rays resemble the dorsal; the spines are strong, the second, the longest, about  $2\frac{1}{2}$  of the head. The anus is situated a little in front of the first spine. The pectoral is nearly triangular, the longest ray  $\frac{2}{3}$  of the head. Each ventral is enclosed by two elongated scales; the spine is  $\frac{1}{2}$  of the length of the head; the anterior ray is undivided, filamentous, its length equals that of the head; from the second, which slightly exceeds the spine, the rest gradually decrease. The individual described was observed at Pinang in August 1845. The fishermen declared it to be a young one, and of rare occurrence. A second, of somewhat larger size, was taken on the coast of Malacca.

(SUB-FAM. MENOINÆ.)

*CÆSIO*,\* (*Commerson*) *Cuv. and Val.* 1830.

Dorsal and anal fin covered with small slender scales; mouth very slightly protractile; no teeth on the vomer; a pointed scale above the root of each ventral, and a third between the fins; on the occiput a chevron or crescent with the horns backwards pointed.

*CÆSIO CÆRULAUREUS*,† *Lacépède*. VAR.

Head above and back deep blue, changing to bluish olive on the sides; an indistinct golden line from the orbit along the sides, in the centre of which it changes to silvery blue, continued to the root of the caudal; opercle golden; cheeks, preopercle, subopercle and interopercle, lower half of the sides and abdomen silvery glazed with cherry red; dorsal pale olive grey, the membrane minutely and closely dotted with brown and edged with black; caudal membrane black, rays yellowish olive, the upper, lower and posterior margin cherry; ventrals and the spiny part of anal white, the membrane of the soft anal rays pale cherry; the three upper rays of the pectoral white, the rest pale cherry; on the inner side at the root a large black spot, continued as a small black point outside at the root of the three upper rays. Iris golden, the orbital margin blackish.

D 10/15, C 17 $\frac{1}{2}$ , A 3/12, V 1/5, P 21, Br. VI.

\* *Cæcio*, *Lacépède*, 1800, is founded upon erroneous characters.

† *Lacép.* III. 86.—*Picarel raillard*, *Quoi and Gaim. Freycin*, 290, Pl. 44, fig. 3.—*Cuv. Val.* VI. 434.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH :  $6\frac{1}{2}$  inch.

The scales are large, deciduous ; there is no crescent-shaped space on the occiput, which is uniformly covered with scales, which advance on the crown as far as midway between the eyes. The present nearest approaches the Variety from the Red Sea, which Prof. Ehrenberg denominated *cæruleo-tæniatus* ; it also resembles *C. chrysozona*, Kuhl and Van Hasselt, apud Cuvier and Valenciennes. As the distribution of colours of *C. cæruleus* is liable to considerable variations, *chrysozona* may turn out to be but a Variety. The description of the present was drawn up from a single dead specimen, observed in the fish-bazar at Pinang in 1845. The fishermen were unacquainted with the fish, and had on that account put it aside.

GEN. CATOCHAENUM,\* *Cantor.*

(Equivalent to GERRES, *Cuvier.*)

Mouth very protractile downwards ; the jaws with velvety teeth ; the angle and inferior margin of the preopercle minutely toothed in some, in others not ; opercle terminating in an obtuse angle ; body compressed, high ; chest square beneath ; head, cheeks and opercles like the body with large, deciduous scales ; anterior dorsal and anal spines more elongated than the rest ; the base of these fins is hid in a scaly sheath ; the ventral fins with an elongated scale above the root.

CATOCHAENUM LIMBATUM, (Cuv. and Val.)

*Gerres limbatus*, Cuv. and Val. VI. 476.

Silvery with lilac reflections ; dorsal, caudal and anal fins pale yellow ; dorsal spines, rays and membrane minutely dotted with brown, the upper margin black, caudal with a broad blackish margin ; ventrals and pectorals white. Iris silvery or pale golden.

D  $9\frac{10}{10}$ , C  $17\frac{1}{2}$ , A  $3\frac{7}{7}$  or 8, V  $1\frac{1}{5}$ , P 15 or 16, Br. VI.

HABIT.—*Sea of Pinang.*

Malabar, Pondicherry.

TOTAL LENGTH : 7 inch.

The greatest vertical diameter is contained three times and one-third in the total length. The length of the second dorsal spine is contained two and a half times in the vertical diameter. In the adult this spine

\* *Kéru*, downwards ; *χαίρων*, yawning. Substituted for *Gerres*, Cuvier, 1829, pre-occupied by *Gerres*, (Latr.) Fabricius, 1794, (*Hemiptera*.)

slightly exceeds the third in length, but in the young the two spines are of equal length, and the lower margin of the preopercle is finely toothed, of which all trace is obliterated in the adult. The blackish margin of the caudal is very indistinct in the young, which bears a strong resemblance to *Catochaenum lucidum*, (Cuv. and Val.)

Young individuals of this species are exceedingly numerous at Pinang at all seasons, and large quantities are dried. Large individuals are of comparatively rare occurrence.

*CATOCHAENUM FILAMENTOSUM*, (Cuv. and Val.)

Russell LXVII. Woodawahah.

*Gerres filamentosus*, Cuv. and Val. VI. 482.

*Gerres filamentosus*, Bleeker : Verh. Bat. Gen. XXII., 4.

Head above and back pale greenish grey, the rest of the body silvery with lilac reflections; above and following the lateral line two parallel series of large oval blackish spots; below the lateral line one or two straight series of similar, but smaller spots; dorsal, caudal and anal fins pale yellow; the spines, rays and membranes of the dorsal and caudal minutely dotted with brown; the superior margin of the dorsal black; the posterior margin of the caudal pale blackish; ventrals and pectorals white. Iris pale golden.

D 9/10, C  $17\frac{1}{2}$ , A  $3\frac{7}{7}$ , V  $1\frac{5}{5}$ , P 15, Br. VI.

HABIT.—*Sea of Pinang.*

Madura, Vanikolo, New Guinea, Java, Coromandel.

TOTAL LENGTH :  $7\frac{1}{2}$  inch.

The length of the second dorsal spine appears to vary: in an adult and a few young, it but slightly exceeded the vertical diameter of the body, and did not reach the caudal fin, as described by M. M. Cuvier and Valenciennes. The young ones have no series of blackish spots, which vanish soon after death; in the smallest examined,  $4\frac{1}{2}$  inches in length, the margin of the preopercle was not toothed. This species but rarely visits Pinang.

FAM. SCIÆNOIDÆ.

SUB—GEN. OTOLITHUS, *Cuvier* 1829.

Head gibbous, supported by cavernous bones; preopercle toothed or crenulate; bony opercle terminating in one or two flat points; dorsal fins two, or one deeply emarginated, the soft part of which longer than

the spinous ; anal spines extremely small ; strong canines in the upper jaw, and in some also in the lower ; under the symphysis of the latter two very minute pores, or none ; air-vessel in some\* with a hornlike, forwards directed process on each side ; † a very large loose bone in each auricular cavity ; branchiostegous rays 7. ‡

OTOLITHUS BIAURITUS, Cantor.

Ikan Salámpai, sometimes Járang gígi, of the Malays.

*Adult.* Head above and back greenish grey with golden reflections ; sides golden orange, paler towards abdomen, everywhere minutely dotted with brown ; lateral line golden ; dorsal, caudal and anal fins brownish yellow or pale orange, minutely dotted with brown, black towards the margin ; ventrals pale orange ; pectorals brownish with a black spot in axilla, spreading over the basal third of the nine upper rays. Iris golden orange.

*Young.* Paler than the adult ; abdomen silvery buff ; upper half of opercle silvery bluish black ; the spot in the axilla very indistinct or absent.

$$D. \left\{ \begin{array}{l} 9-1/27, \\ 9-1/30, \\ 9-1/32, \\ 8-1/32, \end{array} \right\} C 17\frac{1}{2}, A 2/7, V 1/5, P 19, Br. VII.$$

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore, Lancavy. Tenasserim Provinces.*

TOTAL LENGTH: 3 feet.

This fish is of a very elongated cylindrical form, not unlike that of the Genus *Ophiocephalus* ; the profile of the back and abdomen is nearly horizontal, imperceptibly sloping towards the bluntly pointed muzzle. The length of the head is from  $4\frac{1}{2}$  to  $\frac{1}{2}$  of the total ; the depth at occiput exceeds by  $\frac{1}{2}$  half the length of the head. The eye occupies about the second eighth of the length of the head ; the anterior upper half of the orbit borders upon the profile, while the posterior half deviates downwards ; the greatest oblique diameter is  $\frac{1}{2}$  of the length

\* M. M. Cuvier and Valenciennes add (*Hist. Nat. des Poiss. V.*) that such is the case in the species dissected by them.

† In others with numerous lateral branched appendages ; Vide infra *Otolithus ruber* and the subsequent species.

‡ The Malays distinguish the fishes belonging to the Genus *Otolithus* by the common denomination of *Járang* (distant, open), *gígi* (tooth).

of the head, while the vertical is but  $\frac{2}{3}$  of the oblique diameter. The head above is depressed, slightly arched between the eyes, the distance of which is about double the oblique diameter. The nostrils open closely in front of the eye: the posterior obliquely oval aperture is but little larger than the minute rounded anterior, the margin of which is provided with a small raised membranous fold. The mouth is large; the widely arched upper jaw is hidden when the mouth is closed, by the scaly fold which covers the infraorbitals; the lower jaw is scaly, narrower, more pointed, and slightly shorter than the upper, which is naked, with longitudinal striæ, and a rather large triangular impression near the angle, which is situated opposite the posterior part of the orbit. In the upper jaw appear an external series of pointed inwards arched, distant teeth. On each side of the symphysis is one or two canines, larger than the rest; the other teeth gradually decrease in size towards the angle of the mouth. At a slight interval behind the external appears a second narrow series of minute crowded conical (card-like) teeth. In the lower jaw the external series consists of conical teeth, although small, yet perceptibly larger than the card-like ones of the upper jaw. The internal series consists of single distant large teeth, increasing in size as they approach the angle of the mouth. The tongue is large triangular, pointed, fleshy on each side of the base, flat, bony in the centre, membranous towards the margins and the apex. The angle of the preopercle is rounded, the ascending margin is but very indistinctly crenulated. The bony part of the opercle terminates in two flat points of which the upper is the smaller; both are enveloped in a membranous point, projecting beyond the root of the pectoral fin, and formed by a prolongation of the subopercle. The third upper branchiostegous ray is very broad, like the blade of a sabre. Above the pointed termination of the opercle appears another, triangular point, formed by a lobe of the skin, the scales of the margins of which terminate in short setaceous points. This second, earlike appendage also appears in *Otolithus pama*,\* (Buchan. Ham.) The body is elongated cylindrical, compressed towards the back; the vertical dia-

\* SYN. *Bola pama*, Buchan. Ham. 79, 368, Pl. 32, Fig. 26.—*Sciæna pama*, Cuv. and Val. V. 55, Pl. 101, who observe it might with equal propriety be considered a species of *Otolithus*. Their description appears to have been drawn up

meter taken in front of the dorsal fin is  $6\frac{1}{2}$  of the total length. The dorsal spines are very slender; the third is the longest, equalling about  $\frac{1}{2}$  of the vertical diameter; the rest gradually decrease towards the ninth, but the last spine is longer, nearly  $\frac{1}{2}$  of the third. The caudal fin is rhomboidal very pointed, its length from  $6\frac{1}{2}$  to  $7\frac{1}{2}$  of the total. The pectorals are very pointed  $5\frac{1}{2}$  to  $6\frac{1}{2}$  of the total. The ventrals and the anal are equal  $\frac{1}{2}$  of the length of the head. The second anal spine is scarcely one half of the length of the rays, very attenuated, and not striated. The scales of the body are moderate, deciduous; the lateral line is very distinct and proceeds obliquely downwards to the very point of the caudal. The air-vessel is nearly one half of the total length, narrow, tapering backwards to a fine point. On each side of the latter commences a narrow tape-like process, which continuing along each side, deviates at a little distance from the fundus of the air-vessel, which it again joins. The organ might be compared with an elongated antique urn with two handles. From the anterior part of each of the latter proceed five branches, the four of which give off smaller ones to each side, and the fifth is tortuous and larger than the rest. This organ strongly resembles that of *O. pama*, (Cuv. and Val. V. Pl. 138,) yet it presents differences more easily perceived by comparison than described.

This species approaches to *O. senegalensis*, Cuv. and Val. and to *O. pama*, from which latter it, however, differs in its more elongated form, particularly of the head, and in having much fewer rays in the dorsal fin. *O. reevesii*, Richardson, (Rep. 1845, 224,) differs in having 10—1/31 in the dorsal fin, the preopercle spinously toothed on the upper limb and rounded corner, where the teeth are large, and in having the second anal spine stout and finely striated. Single individuals occur at Pinang at all seasons, but numbers from June to August. Although not much esteemed by Europeans, this fish is consumed by the natives both fresh and dried. It yields a large quantity of isinglass, which in the Chinese market is considered to be of the best quality, and fetches 40 to 45 Spanish Dollars per Pikul.

#### OTOLITHUS RUBER, (Bloch-Schneider.)

*Johnius ruber*, Bloch-Schn. 75, No. 3, Pl. 17.

from young specimens, in which the canines are less developed than in the adult, in which they appear as strong and conspicuous as in several species of *Otolithus*. The form of the airvessel is not exclusively characteristic of *pama*.

*Otolithus ruber*, Cuv. and Val. V. 60, Pl. 102.

*Otolithus ruber*, Swainson, Nat. Hist. Fish. II. 219.

Jarang gigi of the Malays.

*Adult.* Head above and back pale brownish red with silvery, iridescent reflections; sides of the head and parts beneath the lateral line reddish or pure shining silvery; upper part of opercle steel-blue; lateral line silvery; dorsal pale brownish red, the membrane minutely dotted with brown; the other fins pale reddish yellow. Iris reddish golden, brown towards the orbit.

*Young.* Sides of the head and parts beneath the lateral line silvery pale orange.

D 10—1/29 or 30, C 17½, A 2/7, V 1/5, P 16, Br. VII.

*HABIT.*—Sea and estuaries of Pinang, Malayan Peninsula, Singapore, Coromandel, Malabar. [pore.

**TOTAL LENGTH:** 2 feet 6 inch.

The length of the head is  $3\frac{1}{2}$  times in the total; its vertical diameter equals the distance from the muzzle to the anterior margin of the preopercle, or exceeds by  $\frac{1}{2}$  half the length of the head. The greatest oblique diameter of the eye is  $\frac{1}{2}$  of the length of the head. The depth of the body in front of the dorsal is contained  $4\frac{1}{2}$  times in the total length. In the young the caudal fin is rhomboidal, pointed; but with age it becomes rounded, and its length little less than  $\frac{1}{2}$  of the total. On each side of the symphysis of the upper jaw appear two large arched canines, of which the exterior is the shorter; between the two pairs rise two distant smaller, yet conspicuous teeth. On each side of the symphysis of the lower jaw appears a long canine; in most individuals but one such is visible, the corresponding one being either missing or much smaller. Behind the canines both jaws have an external series of small conical teeth, and in the upper appears an inner series of velvety. But the lower jaw has but a few such behind the canines on the symphysis. The stomach is elongated, cylindrical with four cœcopyloric appendages. In several it contained remains of fishes, of a small *Melania* and *Crustacea*. The air-vessel is large, flattened, broad lanceolate, terminating behind in a short point. Its length is  $\frac{1}{2}$  of the body, the caudal not included. On each side of the body of the vessel appear 34 processes, of which the anterior four or five divide in four branches, the next in three, the next in two, but the posterior processes, which are slightly



longer than the preceding, are simple ; all again divide in minor ramifications. The isinglass is considered very good, and sells in the Chinese market from 40 to 45 Spanish Dollars per Pikul. The fish is consumed both in fresh and dried state. Single individuals occur at Pinang at all seasons, but they are plentiful from June till August.

**OTOLITHUS ARGENTEUS**, Kuhl and Van Hasselt.

*Otolithus argenteus*, Cuv. and Val. V. 62.

*Otolithus argenteus*, Richardson, Rep. 1845, 225.

*Otolithus argenteus*, Bleeker : Verh. Bat. Gen. XXII, 4.

Jarang gigi of the Malays.

*Adult.* Head above and back iridescent greyish green, with pale reddish reflections ; sides of the head and beneath the lateral line reddish golden ; upper part and posterior margin of opercle blackish blue ; membrane of the whitish dorsal spines reddish transparent, of the rays and caudal reddish yellow, minutely dotted with brown, margin black ; pectoral, ventrals and anal pale yellowish red ; ventral and anal spines whitish. Iris golden, bluish black towards the orbit.

*Young.* Sides of the head and beneath the lateral line pale golden orange ; upper part of opercle steel blue ; soft dorsal, caudal, anal, ventrals and pectorals orange or yellowish red more intense than in the adult.

D 9 or 10— $1/26$ , 27 or 28, C  $17\frac{1}{4}$ , A  $2/7$ , V  $1/5$  P 20, Br. VII.

**HABIT.**—*Sea and estuaries of Pinang, Malayan Peninsula, Singa-Malabar, Celebes, Madura, Batavia.* [pore.

**TOTAL LENGTH :** 2 feet 7 inch.

The length of the head is  $\frac{1}{4}$  of the total, its greatest vertical diameter exceeds by  $\frac{1}{4}$  half the length of the head. The oblique diameter of the eye is  $5\frac{1}{2}$  of the length of the head. The vertical diameter in front of the dorsal is  $5\frac{1}{2}$  of the total length. On each side of the symphysis of the upper jaw appear two, sometimes three canines, of which the posterior, or centre one when three are present, is the longest, but all are shorter and more distant than those of *O. ruber*. The canines are succeeded by a series of distant conical teeth of a comparatively larger size than those in *O. ruber*. Behind the external series is an inner one of velvety teeth. On each side of the symphysis of the lower jaw is a very small canine, preceding a series of velvety teeth, behind which is an inner series of large dis-

tant conical teeth, some of which in size exceed the lower canines. The lateral line describes an arch, terminating opposite the middle of the soft dorsal fin, from whence it proceeds horizontally to the point of the caudal. The latter fin is rhomboidal; its length about  $5\frac{1}{2}$  of the total. The stomach is elongated, cylindrical, containing fishes and *Crustacea*. There are six cœcopyloric appendages. The body of the air-vessel is very narrow, lanceolate, about  $\frac{1}{4}$  of the length of the fish, terminating in a fine point. From each side of the body of the air-vessel proceed 25 branched processes, of which the anterior are the longest and have the greatest number of branchlets.

At Pinang this species is taken in numbers from June till August. It is valued by the natives as an article of food. Owing to the small size of the air-vessel, it yields but a small quantity of isinglass, the quality of which however is considered very good. M. M. Cuvier and Valenciennes have observed this species figured in Colonel Farquhar's collection of drawings at the India House, and its name is said to be at Malacca: *Ikanhampay*, which most likely is a mistake for *Salampai*, the Malayan denomination of *O. biauritus*.

OTOLITHUS MACULATUS, Kuhl and Van Hasselt.

Otolithus maculatus, Cuv. and Val. V. 64.

Jarang gígi of the Malays.

Head above and back iridescent yellowish brown, lighter, silvery on the sides; cheeks, preopercle and abdomen silvery buff; upper part of opercle steel blue; lateral line shining silvery; on the back and sides to within a little beneath the lateral line, a number of brownish spots, the scales of each spot edged with black; dorsal, anal, ventral and pectoral fins yellowish light grey, their membranes minutely dotted with brown; caudal rays silvery at the base; posterior half and membrane brownish yellow; single large irregular black spots scattered over the fin. Iris pale golden, blackish towards the orbit.

D 10— $1\frac{3}{4}$ , C  $17\frac{1}{4}$ , A  $2\frac{1}{11}$ , V  $1\frac{1}{5}$ , P 18, Br. VII.

HABIT.—*Sea and estuaries of Pinang, Malayan Peninsula, Singapore.*

Batavia.

[port.

TOTAL LENGTH: 2 feet 9 inch.

The length of the head is  $3\frac{1}{2}$  of the total; its greatest vertical diameter exceeds by  $\frac{1}{4}$  half the length of the head. The oblique diameter of the eye is a little more than  $\frac{1}{4}$  of the length of the head. The ver-

tical diameter of the body in front of the dorsal is  $5\frac{1}{2}$  of the total length.

The dentition resembles that of *Otolithus ruber*, but the external series of the lower jaw consists of fewer, more distant and stronger conical teeth. The lower jaw greatly projects beyond the upper. In the adult the caudal fin is nearly rounded; its length is  $7\frac{1}{2}$  of the total. The pectorals and ventrals are comparatively short, their length equaling that of the caudal. The stomach is very elongated, cylindrical, thin. In it were found fishes, shells of a *Cerithium*, and *Crustacea*. The air-vessel is very large, broad lanceolate, tapering behind into a fine point. The length is one half of the body, the caudal fin not included. Each side has from 52 to 55 branched processes, the number of which differs not only individually, but from side to side. The lower abdominal surface of the body of the vessel is perfectly smooth, and as usual, silky white, but the upper or vertebral surface is longitudinally divided by a narrow furrow, from which proceed a number of distant, backwards arched, transversal lines or ribs. The intervals between the latter are filled up by short backwards bifurcating raised lines, of which those nearest the central furrow are directed obliquely inwards; but they increase in length, and become longitudinal towards the margin of the vessel, while those covering the lateral branched processes deviate outwards and are much longer than the rest. Thus the whole of the upper or vertebral surface of the air-vessel presents a kind of raised network of singular beauty. This species, although not uncommon, appears at Pinang to be less numerous than the others, which it accompanies. It is reported to be flavourless, but it is highly valued for the sake of the air-vessel, which yields a considerable quantity of the best kind of isinglass.

*OTOLITHUS VERSICOLOR*, Cuv. and Val. ?

Russell CIX. Pottee Kanasah ?

*Otolithus versicolor*, Cuv. and Val. V. 64 ?

Jarang gigi of the Malays.

*Young.* Head above and back iridescent greyish green, lighter on the sides; cheeks and preopercle silvery; opercle steel-blue; sides beneath the lateral line silvery white; lateral line shining silvery; fins yellowish buff; membrane of the spinous dorsal and marginal half of the soft, of the anal and caudal minutely dotted with black, on the

latter fin so closely as to produce a general blackish colour. Iris narrow golden round the pupil; the rest bluish black.

D 10— $1\frac{1}{25}$ , C  $17\frac{1}{2}$ , A  $2\frac{7}{7}$ , V  $1\frac{1}{5}$ , P 18, Br. VII.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH :  $6\frac{1}{2}$  inch.

The length of the head is about  $\frac{1}{2}$  of the total; its greatest vertical diameter exceeds one half the length by  $\frac{1}{4}$ . The oblique diameter of the eye is  $5\frac{1}{2}$  of the length of the head. The vertical diameter in front of the dorsal is about  $\frac{1}{4}$  of the total length.

The dentition, as represented by Russell, resembles that of *O. maculatus*. The broad triangular part of the upper jaw at the angle of the mouth, is finely radiated, but without the large triangular impression, which appears in some of the other species. The second anal spine is proportionally stronger than in the other species; its length slightly exceeds  $\frac{1}{2}$  of the anterior ray, and the two lateral surfaces are compressed, finely radiated, whereas in the preceding species this spine is rounded. The air-vessel is lanceolate with numerous lateral branching appendages; its length equals that of the head, or about  $\frac{1}{4}$  of the total length. The only individual observed, occurred at Pinang in 1844. It resembles more *O. versicolor* than any of the preceding species: Russell indeed gives 21 dorsal rays, but their number varies considerably in all. In the present, as well as in the young of the preceding, the caudal fin is proportionally much longer and more pointed than in the adult, and the eye is also proportionally larger.

GEN. JORNIUS, *Bloch-Schneider*, 1801.

Velvety teeth in both jaws: in the upper an external series of arched teeth, considerably longer and more distant than the rest; in the lower an internal series of conical teeth somewhat longer than the rest. Differs from *Sciæna* by the comparative greater thickness and length of the second anal spine, which is nearly two thirds of that of the first ray.

JORNIUS DUSSUMIERI, (Cuv. and Val.)

*Corvina dussumieri*, Cuv. and Val. V. 119.

Head above and back dark greenish brown, paler, silvery on the cheeks, preopercle and sides; opercle steel-blue; the scales minutely dotted with brown; abdomen pearl-coloured; membrane of dorsal transparent, minutely dotted with brown, edged with black; caudal

and anal yellowish white, minutely dotted with black, their marginal part blackish; ventrals white; upper half of pectorals brownish, lower yellowish white. Iris silvery, upper part bluish black.

D 10—1/28 or 29, C 17½, A 2/7, V 1/5, P 19, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Malabar.

TOTAL LENGTH: 6¼ inch.

The teeth of the external series of the upper jaw are distant, but little longer than those of the internal. Under the symphysis of the lower jaw appear five pores. The anterior part of the air-vessel is dilated, forming a rounded lateral process on each side of the vertebral column. Immediately behind them the body of the vessel is constricted, and the rest presents a broad lanceolate form, tapering backwards into a sharp point. From each side proceed ten processes of which the eight are branched, but the two posterior pairs, the longest, are either simple or bipartite. The length of the air-vessel is about ¼ of the total.

At Pinang single individuals occur at all seasons. The isinglass is reputed good, but as the fish is of small size and not numerous, but little is procurable.

JOHNIUS BELENGERI, (Cuv. and Val.)

*Corvina belengeri*, Cuv. and Val. V. 120.

*Corvina belengeri*, Bélanger, 358.

Colours similar to those of *J. dussumieri*, but the body and fins so closely dotted with black and brown as to impart a general pale brownish appearance; the marginal half of the caudal, anal and ventral fins blackish. Iris silvery, upper half bluish black.

D 10—1/28, 29 or 30, C 17½, A 2/7, V 1/5, P 17, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Malabar.

TOTAL LENGTH: 6¼ inch.

The teeth of the external series of the upper jaw are less distant, and rather longer than in *J. dussumieri*. There are five pores under the symphysis of the lower jaw. The form and length of the air-vessel is that of *J. dussumieri*; each side has ten branching processes, shorter, however, and apparently placed at a greater distance from each other than in the former species. The three posterior pairs are much longer

than the preceding, the eighth and ninth bipartite, the tenth pair is undivided, pointed. Also this species occurs singly at Pinang.

The two preceding species not only closely resemble each other, but also a third: *Johnius coitor*, (Buchanan Hamilton.\*) Their external distinguishing characters will appear from the following table.

|                                          | <i>Johnius dussumieri.</i>                          | <i>Johnius belengeri.</i>                                            | <i>Johnius coitor.</i>                   |
|------------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------|------------------------------------------|
| Length of the head ..                    | $4\frac{1}{2}$ in total length                      | $\frac{1}{2}$ of total length.                                       | $\frac{1}{2}$ of total length.           |
| Depth at occiput ....                    | $\frac{2}{3}$ of the length of the head.            | $\frac{1}{3}$ of the length of the head.                             | $\frac{2}{3}$ of the length of the head. |
| Diameter of the eye ..                   | $\frac{1}{2}$ of do.                                | $3\frac{1}{2}$ in do.                                                | $5\frac{1}{2}$ in do.                    |
| Distance from the muzzle to the eye..... | equal the diameter of eye.                          | $\frac{1}{2}$ less than the diameter.                                | exceeding the diameter by $\frac{1}{2}$  |
| Depth in front of dorsal fin .....       | $5\frac{1}{2}$ in total length.                     | $\frac{1}{2}$ of total length.                                       | $\frac{2}{3}$ of total                   |
| Length of the posterior anal spine ..... | slightly exceeding $\frac{1}{2}$ of first anal ray. | $\frac{2}{3}$ of the first ray but slenderer than in <i>coitor</i> . | $\frac{2}{3}$ of the first anal ray.     |

#### JOHNUS CARUTTA, Bloch.

*Johnius carutta*, Bl. Pl. 356.

*Corvina carutta*, Cuv. and Val. V. 124.

Head above and back dark brown claret colour, lighter, silvery on the cheeks, opercles, sides and abdomen; the scales minutely dotted with black, and their margins of a darker brown than the ground colour; fin-membranes pale whitish yellow, minutely dotted with black; the upper half of the spiny dorsal, from 2<sup>d</sup>. to 7<sup>th</sup>. spine, black; the soft dorsal with four equidistant, large, oblique black spots; the marginal half of the caudal, anal and ventral fins blackish. Iris golden, the orbital half bluish black.

D 10—1/28, C 17 $\frac{1}{2}$ , A 2/8, V 1/5, P 18, Br. VII.

HABIT.—*Sea of Pinang.*

Malabar; sea and rivers Tranquebar, Pondicherry.

TOTAL LENGTH: 6 inch.

The length of the head is  $4\frac{1}{2}$  in the total, the depth at the occiput  $\frac{2}{3}$  of its length. The transversal diameter of the eye is  $\frac{1}{2}$  of the length of the head, equal to its distance from the muzzle. The vertical diameter in front of the dorsal fin, is little less than the length of the

\* SYN. *Bola coitor*, Buchan. Ham. 75, 368, Pl. 27, Fig. 24.—*Corvina coitor*, Cuvier and Valenciennes, V. 116.

head. The external series of teeth of the upper jaw is but little larger than the external; the velvety teeth of the lower jaw, form a broader band than those of the upper. Under the symphysis of the lower jaw appear four pores. The second anal spine is very thick,  $\frac{2}{3}$  of the length of the first ray. A single individual was observed at Pinang in May 1845.

**JOHNIUS DIACANTHUS, (Lacépède.)**

*Lutjanus diacanthus*, Lacépède IV. 195, 244.

Russell CXV. Nalla Katchelee. (*Adult.*)

Russell CXVI. Katchelee. (*Young.*)

*Johnius cataleus*, Cuvier, R. A. II. 173(4.)

*Corvina catalea*, Cuvier and Valenciennes, V. 128.

(*Icon*). *Sciaena maculata*, Gray, Ill. Ind. Zool. II. Pl. 89, Fig. 3.

(*Young.*)

*Corvina catalea*, Bélanger, 360.

*Corvina catalea*, Richardson : Rep. 1845, 226.

*Corvina nalla katchelee*, Richardson l. c.

*Corvina catalea*, Bleeker : Verh. Batav. Gen. XXII. 4.

Ikan Tambaréh of the Malays.

*Young.* Head above and back dark brown claret colour; cheeks, preopercle, and sides to a little beneath the lateral line lighter with lilac silvery reflection, the scales edged with dark brown, and the back and upper half of the sides with numerous larger and smaller round black spots; lower half of the sides silvery buff; the scales minutely dotted with brown; opercle silvery lilac or blue; dorsal and caudal fin membranes brownish buff, minutely dotted with brown, and with more or less numerous large black scattered spots; anal, ventrals and pectorals brownish buff at the base, the rest pale neutral tint, minutely dotted with brown, and the marginal half black.

*Adult.* Head and sides darker, with or without indistinct black spots; sides beneath the lateral line pale silvery bluish or lilac brown; opercle blackish blue; branchiostegous rays and membrane pale lilac silvery; dorsal-, caudal- and anal membranes pale yellowish brown, minutely dotted with brown, with or without indistinct large dark brown spots; ventrals and pectorals yellowish brown, posterior half blackish. Iris silvery lilac, minutely dotted with brown; the orbital half, bluish black.

D 10—1/24, C 17½, A 2/7, V 1/5, P 19 or 20, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Malabar, Coromandel, Bay of Bengal, Gangetic estuaries,

. Tenasserim, Canton, China Seas, Madura, Java.

TOTAL LENGTH : 2 feet 9 inch.

The length of the head is  $3\frac{1}{2}$  in the total, the caudal fin not included. In the young the latter fin is rhomboidal, very pointed, and its length equal to that of the head ; but with age the point becomes worn, and in the adult the length is but  $\frac{2}{3}$  of that of the head, or equal to the depth at the occiput. The oblique diameter of the eye is a little less than  $\frac{1}{2}$  of the length of the head ; the distance from the muzzle to the eye exceeds the diameter by  $\frac{1}{2}$ . The vertical diameter in front of the dorsal fin is  $\frac{1}{2}$  of the total length. The teeth of the external series of the upper jaw are long, distant, and there is generally a canine on one or both sides, at a little distance from the symphysis. The lower jaw has a smaller canine on each side of the symphysis, and an internal series of longer conical teeth. Under the symphysis appear four large pores, and in some a fifth, very minute. The air-vessel,  $\frac{1}{3}$  of the length of the fish, is of a broad, lanceolate shape, tapering behind into a very elongated point. Each side has 20 to 24 processes, of which the two posterior pairs are simple or bipartite ; the rest branching. The contents of the stomach of one dissected were the remains of a species of *Leptocephalus* and an eel, of Crustacea, and of a *Loligo*. At Pinang individuals of this species occur at all seasons, but in numbers and of the largest size, from June to August. They are not only valued as articles of food, but also on account of the quantity and quality of the isinglass, which sells in the China market from 40 to 45 Spanish Dollars per Pikul.

JOHNIUS MACULATUS,\* Bloch-Schneider, VAR. ?

Head above and back dark greyish green, lighter, silvery on the cheeks, opercles and sides, the scales minutely dotted with black, not, however, sufficiently to influence the general colour ; abdomen silvery ; membrane of dorsal spines transparent with black margin ; between the anterior six spines dotted throughout, and rather largely with black and brown ; between the four posterior spines the central part of the

\* SYN. Russell CXXIII. *Seri Kulla*.—*Johnius maculatus*, Bl. Schn. 75.—*Corvina maculata*, Cuvier and Valenciennes, V. 126.



membrane without dots; membrane of dorsal rays, caudal and anal yellowish white, minutely dotted with brown and black, their marginal portion blackish; pectorals and ventrals whitish, the latter dotted with black, particularly towards the margin. Iris silvery, dotted with black; upper orbital half bluish black.

D 10—1/23, C 17½, A 2/7, V 1/5, P 19, Br. VII.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 5 inch.

The length of the head is  $4\frac{1}{2}$  in the total, its vertical diameter at the occiput  $\frac{2}{3}$  of the length. The oblique diameter of the eye is  $3\frac{1}{2}$  in the length of the head; the distance from the muzzle is less than the oblique diameter. The vertical diameter in front of the dorsal fin equals the length of the head. The distance from the orbit, across the infraorbitals, exceeds  $\frac{1}{2}$  of the diameter of the eye. This character may serve at once to distinguish a very closely allied species: *Johnius chaptis*\* (Buchan. Ham.), in which the breadth of the infraorbitals is much less. The anterior teeth of the external series of the upper jaw are rather long and closely set; the rest are scarcely longer than the rather broad internal series of velvety teeth. Under the symphysis of the lower jaw appear five pores. The lower part of the rounded margin of the preopercle is distinctly and distantly toothed. The opercle terminates in two flat spines. The lateral line is distinct; on each scale appears a small longitudinal tube, from whence proceed an upper and lower oblique process. Most of the scales of the sides have each a central oblique line. The second anal spine is rather strong, longitudinally radiated, and  $\frac{2}{3}$  of the length of the first ray. The caudal fin is rhomboidal somewhat rounded at the point. From the defective descriptions of *Johnius maculatus*, it is impossible to determine if the present is specifically distinct or a variety. A single individual was observed in 1844 at Pinang. The form of the air-vessel and the number of the lateral appendages resemble those of *Johnius belengeri*.

SUB-GEN. CORVINA, Cuvier, 1829.

Differs from *Johnius* by the comparatively greater size of the second anal spine, the length of which nearly equals that of the first anal ray.

\* SYN. *Bola chaptis*, Buch. Ham. 77, 368, Pl. 10, Fig. 25.—*Corvina chaptis*, Cuvier and Valenciennes, V. 130.

## CORVINA SOLDADO, (Lacépède.)

Holocentre soldado, Lacépède, IV. 344, 373.

Russell CXVII. Tella Katchelee.

Corvina\* miles, Cuvier and Valenciennes, V. 94, IX. 474.

Sciæna argentea, Kuhl and Van Hasselt MS. Cuv. and  
[Val. V. 95.

*Adult.* Head above and back iridescent greyish green; lighter, silvery on the cheeks, preopercle and sides; opercle steel-blue in the centre; abdomen pearl-coloured; membrane of dorsal spines transparent, minutely dotted with black and brown, and with black margins; membrane of the rays near the root, and in front of each ray, with a small brownish spot; upper third minutely dotted with brown, the margin black; ventrals whitish; the rest of the fins pale yellowish white, the membranes and rays minutely dotted with black on the marginal half, so closely as to impart a general blackish colour. Iris silvery, upper orbital half bluish black.

*Young.* Of general lighter colours; fins of a deeper yellow; anal spines and three anterior rays and their membrane dotted with brown.

D 10—1/29 or 9—1/30, C 17½, A 2/7, V 1/5 P 16 or 17, Br. VII.

HABIT.—*Sea of Pinang.*

Java, Tenasserim, Coromandel, Bombay.

TOTAL LENGTH: 2 feet.

The length of the head is about  $4\frac{1}{2}$  in the total; the depth at occiput  $\frac{1}{4}$  less than the length. The oblique diameter of the eye is a little less than  $\frac{1}{4}$  of the length of the head; the distance from the muzzle equals the diameter of the eye. The vertical diameter, in front of the dorsal, slightly exceeds the length of the head. The air-vessel is about  $\frac{1}{3}$  of the total length, elongated oval, with numerous lateral branching appendages, which increase in length towards the posterior extremity. Four pores appear under the symphysis of the lower jaw. Small individuals occur at Pinang at all seasons; larger ones but rarely. The fish is eaten by the natives, and the few air-vessels procurable, are valued as good isinglass. M. Dussumier found this species abundant at Bombay.

GEN. UMBRINA, Cuvier, 1817.

Differs from *Johnius* in having a cirrus under the symphysis of the lower jaw.

\* Misprinted "*Sciæna*."

**UMBRINA RUSSELLI, Cuvier.**

Russell CXVIII. Qualar Katchelee.

Umbrina russelli, Cuv. and Val. V. 178.

Umbrina russelli, Richardson: Report 1845, 226.

Ikan Guláma of the Malays.

**Young.** Head above and back silvery greyish green, lighter on the sides above the lateral line; cheeks, opercles and beneath the lateral line shining silvery; from the vertex, between the eyes, a blackish band obliquely backwards over the temple, terminating on the opercle in a large steel-blue spot; behind the occiput a broader black band obliquely downwards to the origin of the lateral line; membrane of the dorsal spines blackish, minutely dotted with brown; of the rays the upper half minutely dotted with brown and black, the lower transparent; the rest of the fins pale orange.

**Adult.** Body paler; in certain lights reflecting fifteen obliquely backwards ascending lines; no trace of the blackish band of the temples, and but a faint of the occipital; a pale steel-blue spot on the opercle; membrane of dorsal spines brownish. Iris silvery, upper orbital half bluish black.

D 10—2/27 or 10—1/26, C 17½, A 2/7, V 1/5 P 17, Br. VII.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Singapore.*

Vizagapatam, Indian and China Seas.

**TOTAL LENGTH:** 6 inch.

The length of the head is  $4\frac{1}{2}$  in the total; the depth at occiput  $\frac{1}{2}$  less than the length. The oblique diameter of the eye is  $\frac{1}{2}$  of the length of the head, equalling the distance of the eye from the muzzle. The vertical diameter in front of the dorsal fin is  $\frac{1}{3}$  of the length of the body, the caudal not included, but with the latter fin it is  $3\frac{2}{3}$  in the total length. The teeth of the external series of the upper jaw, are but little longer than the rest, and rather closely set. The cirrus is thick, fleshy; in the adult fish its length equals the lower jaw to the angle of the mouth, but it is shorter in the young. On each side of and a little behind the cirrus appear two large pores. The fold of the skin covering the infraorbitals and the upper maxillary forms a small rounded lobe on each side of the muzzle. The vertical distance from the lower part of the orbit down the fold is  $\frac{2}{3}$  of the oblique diameter of the eye. The lateral line consisting of a small central tube on each

scale, follows the arch of the back till opposite the middle of the anal, from whence it proceeds nearly straight to the point of the rhombic caudal fin. In individuals with 12 dorsal spines, the eleventh is slightly, the twelfth much longer than the tenth, and their membranes much narrower than those connecting the rest, which from the fourth gradually decrease in length. The pectorals are pointed, their length equalling that of the caudal. The second anal spine,  $\frac{4}{5}$  of the first ray, is compressed, broad except near the root where it is somewhat narrowed. The air-vessel about  $\frac{1}{3}$  of the length of the fish, is elongated oval, terminating in a long thin point. From each side proceed 14 to 16 appendages, of which the two posterior ones are simple or bipartite, and much longer than the preceding branching ones. At Pinang this species is of too rare occurrence to make it valuable as an article of food, or as yielding isinglass, although the latter is considered of good quality. The fishermen assert that individuals upwards of a foot in length have been taken.

GEN. PRISTIPOMA, Cuvier, 1817.

Dorsal fin single, and, as well as the anal, without scales; \* angle of opercle blunt, or hid in the membrane; the external series of the velvety teeth stronger than the rest; under the symphysis of the lower jaw two pores, behind which a small fosset; branchiostegous rays seven.

PRISTIPOMA COMMERSIONI, (Lacépède.)

Labre commersonien, Lacép. III. 431, 477, Pl. 23, Fig. 1.

Lutjan microstome, Lacép. III. Pl. 34, Fig. 2; IV. 181, 216.

Labrus commersonii, Shaw, IV. 493.

Pristipoma kaakan, Cuv. and Val. V. 244, XIII. 8<sup>is</sup>.

Pristipoma commersonii, Cuv. and Val. V. 252.

Pristipoma kaakan? Rüppell: N. W. Fishche, 123, Taf. 30,

[Fig. 1.

Pristipoma kaakan, Richardson: Rep. 1845, 227.

Pristipoma kaakan, Bleeker: Verh. Batav. Gen. XXII. 3.

(Young). Head above and back pale greyish green; opercle bluish silvery, the posterior part minutely dotted with black; cheeks, sides and abdomen silvery; the back and upper part of the sides minutely dotted with black and with distant indistinct brownish spots; fin

\* As observed by M. Swainson, this character does not exist in all species.

membranes transparent ; between the dorsal spines with a black margin and with two or three series of brownish spots ; between the dorsal rays two transversal series of smaller brownish spots ; posterior half of caudal pale blackish. Iris golden.

D 12/14, C 17½, A 3/7 or 8, V 1/5, P 17, Br. VII.

HABIT.—*Sea and estuaries of Pinang, Singapore.*

Sea and estuaries of Coromandel, Malabar, Island of Lantao, China Sea, Balli, Java, Sumbawa, Celebes.

TOTAL LENGTH : 7 inch.

The length of the head and the greatest vertical diameter of the body are contained  $3\frac{1}{2}$  times in the total length. The fourth dorsal spine equals half the greatest vertical diameter of the body. The second anal spine is two thirds of the vertical diameter above it, and as long as the fourth dorsal, but stronger. Individuals of the length described are excessively numerous at all seasons at Pinang and Singapore, where they are consumed by the natives either fresh or dried.

PRISTIPOMA GUORACA, Cuv. and Val.

*Perca grunniens*, Froster ?

*Anthias grunniens*, Bloch-Schneider. 308 ?

Russell CXXXII. Guoraka.

*Pristipoma guoraca*, Cuv. R. A. II. 176<sup>(1.)</sup>

*Pristipoma guoraca*, Cuv. and Val. V. 256.

*Pristipoma guoraca*, Bélanger, 363.

Head above and back pale blackish olive ; cheeks, opercles and sides silvery grey with blue and golden reflections ; abdomen silvery yellowish white ; most of the scales have the edges minutely dotted with brown, and those above the lateral line a pale brown spot at the root, forming six or seven indistinct parallel lines ; fins pale yellowish ; membrane of the dorsal minutely dotted with brown, between the spines one or two series of large clouded brown spots, and a single series of smaller between the rays ; margins of the dorsal and caudal blackish ; the membrane of the latter and of the anal slightly dotted with brown. Iris golden.

D 12/14, C 17½, A 3/8, V 1/5, P 18, Br. VII.

HABIT.—*Sea of Pinang.*

Isle of Tanna, Batavia, Coromandel, Mahé (Fresh-water).

TOTAL LENGTH : 1 foot.

The air-vessel is elongated, nearly one third of the total length, swelling in the middle, terminating in a point; the anterior extremity is blunt and appears to have on each side a pointed process, a little less than one third of the length of the vessel itself, which is restricted at the origin of the lateral processes. The second anal spine is excessively thick, striated on the anterior surface; its length slightly exceeds one half of the vertical diameter of the body above it, but it is considerably less than one half of the vertical diameter at the pectorals. This spine is therefore comparatively shorter in the present species than it is in *P. kaakan*, Cuv. and Val. which it however much resembles in distribution of colour and other characters. The fish is finely flavoured, but its isinglass is of little value, as the air-vessel is very thin. At Pinang it is of very rare occurrence.

**PRISTIPOMA NIGRUM, Mertens.**

*Pristipoma nigrum*. Cuv. and Val. V. 258.

*Young.* Blackish brown, opercles pale silvery; membrane of dorsal spines pale brown with lilac reflections, margin black; soft part of dorsal and anal blackish brown with whitish yellow margin; pectorals and caudal whitish yellow with a blackish vertical band at the root; ventrals blackish brown. Iris King's-yellow with a black orbital margin.

D 14/16, C 17 $\frac{1}{2}$ , A 3/7, V 1/5, P 17, Br. VII.

**HABIT.**—*Sea of Pinang.*

Manila.

**TOTAL LENGTH** (*of the young*): 2 $\frac{1}{4}$  inch.

The head is  $\frac{1}{3}$  of the length of the body, not including the caudal which is  $\frac{1}{3}$  of the total length. The greatest vertical diameter of the body is  $\frac{1}{3}$  of the total length. The eye occupies the second third of the head. The basal half of the soft dorsal, anal, and of the caudal fin covered with minute scales.

This fish, of which a single individual was observed in 1845 at Pinang, appears to be the young of *P. nigrum*, from which it merely differs by the yellowish colour of the caudal, pectorals and of the margins of soft dorsal and anal fins.

**PRISTIPOMA PAIKEELI, Cuv. and Val.**

Russell CXXI. Paikeeli.

*Pristipoma paikeeli*, Cuv. R. A. II. 176 (1.)

*Pristipoma paikeeli*, Cuv. and Val. V. 259.

Silvery brownish white; abdomen buff; on the back and sides as far as the pectoral fin six parallel longitudinal bands, Van Dyke brown, each enclosed by two black lines; fin-membranes yellowish white, all except the pectoral minutely dotted with brown; the margin of the spinal part of the dorsal black; the upper half of the soft part, and the posterior margin of the caudal blackish. Iris golden.

D 12/15, C 17½, A 3/9, V 1/5, P 17, Br. VII.

HABIT.—*Sea of Pinang.*

Madras, Vizagapatam.

TOTAL LENGTH : 6 inch.

The figure of Russell represents the dorsal spines much too slender, and the caudal fin too deeply cleft. It is also defective in not representing the minute scales half covering the membrane of the dorsal rays, of the caudal, anal and of the ventrals. A single individual observed at Pinang in 1845, had nine anal rays, (the last one double.)

*PRISTIPOMA CARIPA*, Cuvier.

*Anthias maculatus*, Bloch, Pl. 326. Fig. 2 ?

*Lutjan tacheté*, Lacépède, IV. 239.

Russell CXXIV. Caripe.

*Pristipoma caripa*, Cuv. R. A. II. 176 <sup>(1.)</sup>

*Pristipoma caripa*, Cuv. and Val. V. 261.

Head above and back brownish black, sides silvery brownish white; cheeks and abdomen silvery white, bluish on the opercles; over the infraorbitals an oblique blackish band, edging the orbit; a second from the occiput, edging the margin of the preopercle and the opercle; a third in front of the dorsal to just beneath the lateral line; three or four blackish spots along the back, three larger, placed in quincunx towards the former, along the lateral line; membrane of dorsal spines hemi-transparent, edged and minutely dotted with black, and with a large black spot between the 4th, 5th, 6th, 7th and 8th spine; upper half of the soft dorsal minutely dotted with black, and with a small indistinct blackish spot in front of the six anterior rays; the other fins pale yellowish white; the membrane of the caudal and anal minutely dotted with brown. Iris golden.

D 12/14, C 17½, A 3/7, V 1/5, P 16 or 17, Br. VII.

HABIT.—*Sea of Pinang.*

Batavia, Coromandel, Malabar.

TOTAL LENGTH : 5 inch.

Two individuals together were observed in 1845 at Pinang, where the fishermen asserted the species to be very seldom seen, and never of larger size.

*PRISTIPOMA AURITUM*, Cuv. and Val.

*Pristipoma auritum*, Cuv. and Val. V. 263.

Upper part of the muzzle dark brown, of the rest of the head the upper half of the opercle and of the lax gill-membrane and the cheeks light brownish grey with silvery reflections; preopercle, lower half of opercle and of the gill-membrane silvery yellowish-white, minutely dotted with brown; back and upper part of the sides light greyish green, lower part of the latter and abdomen yellowish white; the scales of the occiput and upper half of the body with a reddish brown spot at the root, reflecting lilac and forming irregular series or longitudinal lines; the scales of the lower half of the sides silvery at the root, and minutely dotted with brown; fin-membranes whitish transparent, minutely dotted with brown, rays yellowish white; between the dorsal spines numerous reddish brown round or elongated spots, forming from 3 to 6 oblique series; the margin of the membrane black; between the dorsal rays some rounded smaller spots, forming 4 transversal lines. Iris golden.

D 12/14, C 17½, A 3/7 or 8, V 1/5, P 17, Br. VII.

HABIT.—*Sea of Pinang.*

Siam.

TOTAL LENGTH : 1 foot 8½ inch.

The eye occupies the third seventh of the length of the head when the muzzle is protracted; the length of the opercle is little less than one half of that of the head; it is convex and projects backwards above the anterior half of the pectoral; the mouth is comparatively very small with few teeth; the external series under the symphysis of the upper jaw is a little stronger than the rest; those few in the lower jaw nearest the angle of the mouth are the largest, nearly conical. The length of the second anal spine equals that of the fourth dorsal, the longest, and it is nearly ¾ of the vertical diameter of the body immediately above it. The anterior surface of all the spines is longitudinally furrowed. The caudal fin is covered almost throughout with minute rough scales, so as entirely to hide the short accessory rays; the mem-



brane of the ventrals is scaly ; the rest naked. This fish but rarely occurs at Pinang, where it is highly valued on account of its excellent flavour and firmness of flesh. Of four at different times examined, the smallest measured 1 foot 5 inches in length : in external characters all resembled each other except in the number of anal rays, varying from 7 to 8, the last one being double. M. M. Cuvier and Valenciennes describe the specimen discovered by Dr. Finlayson in Siam, with 11 dorsal spines, whereas those from the sea of Pinang present 12. In other characters the latter so perfectly agree with the description, that their identity appears to admit of no doubt.

GEN. PLECTORHYNCHUS, *Lacépède*, 1801.

(DIAGRAMMA, *Cuvier* 1817.)

Two minute pores under the symphysis, and two fossets on each branch of the lower jaw ; preopercle toothed ; lips folded and turned back.

PLECTORHYNCHUS BLOCHII, (*Cuvier* and *Val.*)

*Anthias diagramma*, *Bloch*, Pl. 320.

*Sparus diagramma*, *Shaw*, IV. 440, Pl. 65.

*Diagramma blochii*, *Cuvier* and *Valenciennes*, V. 312.

*Young.* Ground-colour of the head, cheeks, opercles and upper half of the body bright orange, lower half yellowish white ; from between the eyes a longitudinal brown band following the back, continuing above the base of the soft dorsal fin ; a second from the muzzle above the orbit, dividing in two portions which again unite above the middle of the pectoral fin, and continue straight to the posterior part of the soft dorsal ; a third, the broadest, from the eye straight to the root of the caudal ; a fourth under and following the course of the latter ; a fifth and sixth of lighter brown, from the muzzle to the posterior part of the abdomen ; a seventh similar from the gill-opening to the posterior part of the root of the anal fin. The margin of the dorsal membrane black, base and upper part orange, intermediate part milk white ; between the root of the third and fourth dorsal spine a black spot ; from the point of the second to the base of the eighth spine a broad oblique black band, continuing straight to the middle of the soft dorsal, where it unites with the first band of the body, and thus continues to the posterior part of the fin ; caudal orange with scattered irregular black spots ; anal and ventrals greyish, posterior part black ; pectorals

orange with a black band across the root, the centre and the point. Iris golden orange.

D 10/23, C  $17\frac{1}{2}$ , A  $3\frac{1}{3}$ , V  $1\frac{1}{5}$ , P 17, Br. VII.

HABIT.—*Sea of Pinang*

Southern coast of Ceylon.

TOTAL LENGTH :  $5\frac{1}{2}$  inches.

As observed by M. M. Cuvier and Valenciennes this species differs from *Plectorhynchus lineatus*, (Linné,)\* in the greater length of the second, third and fourth dorsal spines, which equals or even slightly exceeds one half of the greatest vertical diameter of the body, and in the comparative shortness of the anterior dorsal spine, which is one third of the length of the second. The first anal spine scarcely exceeds one fourth of the second, which as well as the third, equals the length of the tenth dorsal spine, and slightly exceeds one third of the greatest vertical diameter of the body. The number of fin rays given by M. M. Cuvier and Valenciennes: D 12/16? A 2/7, appears to be incorrect. In fresh state the prevailing, or ground colours of the fish are orange and yellowish white. In the absence of a detailed description of *Bodian cuvier*, Bennett, (*Fishes of Ceylon*, 13,) the species cannot be determined. If the relative proportions of the dorsal spines as represented in the figure, are correct, the fish would appear to be *P. lineatus*.

A single individual was observed at Pinang in 1845.

**PLECTORHYNCHUS BALTEATUS**, (Kuhl and Van Hasselt.)

*Diagramma balteatum*, K and V. H. Cuv. and Val. V. 316.

Bright yellow and black striped; upper part of the back and sides black: a bright yellow narrow longitudinal band from the occiput to the commencement of the soft dorsal fin, sending a short vertical portion to the third dorsal spine; a second yellow broader band from above the orbit straight over the posterior part of the soft dorsal; next a black band from the muzzle, through the eye, across the cheek and opercle, straight to the caudal over which it continues; next a yellow band, bordered beneath by a pale bluish black, following the abdomen to the caudal; cheeks and lower half of opercles yellow

\* SYN. Seba III. XXVII. Fig. 18.—*Perca diagramma*, Linné, Syst. 1319.—*Anthias diagramma*, Bloch, 101, Pl. 9.—*Sciæna lineata*, Lin. Mus. A. F. I. 66.—*Perca lineata*, Linné, Syst. 1319.—*Grammistes lineatus*, Bloch, S. 182.—*Diagramma lineatum*, Cuv. and Val. V. 309.

washed with black ; abdomen yellow. Dorsal spines black, the membrane between the three anterior spines yellow, the rest black ; the soft part of the dorsal yellow with a black margin, beneath which a broad yellow longitudinal band, next a black, but the lower half of the six or seven posterior rays yellow, in continuation of the second yellow band of the body. Caudal fin yellow with a broad black margin, and longitudinally divided by a continuation of the central black band of the body. Anal yellow, lower half as far as the fourth ray black. Membrane, spine and three first rays of ventrals black ; the rest yellow. Pectorals white. On the centre of the whitish lips a black spot. Iris yellow with a transversal black bar.

D 10/23, C  $17\frac{1}{2}$ , A  $3\frac{1}{7}$ , V  $1\frac{1}{5}$ , P 16, Br. VII.

HABIT.—*Sea of Singapore.*

Java.

TOTAL LENGTH :  $3\frac{1}{2}$  inch.

The head is contained  $4\frac{1}{2}$  times in the total length ; the eye is situated a little in front of the second third of the head ; its diameter is a little less than one third of the length of the head. The greatest vertical diameter of the body is  $\frac{1}{2}$  of the length, the caudal fin not included. The first dorsal spine is  $\frac{1}{2}$  of the second, the longest, which slightly exceeds  $\frac{1}{2}$  of the greatest vertical diameter of the body ; the third is a little shorter, the fourth equals half the depth of the body ; the rest gradually decrease, the tenth equalling the first. The second anal spine is remarkably short and slender, its length scarcely exceeding the first dorsal, the second anal is but little shorter and slenderer than the first. The preopercle is very finely toothed ; the opercles terminate in three small membranous points. The caudal fin is nearly rhombic, its length slightly exceeding  $\frac{1}{2}$  of the total. The pectorals are the shortest fins, their length being contained  $6\frac{1}{2}$  times in the total.

The intestinal canal is simple, about  $\frac{1}{2}$  of the total length of the fish ; the stomach is elongated pyriform, the coats thickened : it contained minute shells. There are 5 cœcopyloric appendages, their length is nearly one half of the intestinal canal. The air-vessel is elongated triangular, its length about one third of the total ; from the sides of both its extremities proceed two lateral short, pointed processes, and six equidistant, shorter ones from each side ; its colour is white. A

few individuals (the one described the largest), were observed at Singapore in June 1840.

GEN. LOBOTES, Cuvier, 1829.

Muzzle short; lower jaw prominent; preopercle strongly toothed; the elongated rounded soft portion of the dorsal and anal fin, and the caudal giving the posterior part of the body a trilobate appearance; towards the symphysis of the lower jaw four groups of very minute pores. Branchiostegous rays six.

LOBOTES ERATE, Cuvier and Val.

*Lobotes erate*, Cuv. and Val. V. 322.

*Lobotes farkarii*, Cuv. and Val. V. 324, (*Young?*)

*Lobotes erate*, Bleeker: Verh. Bat. Gen. XXII. 4.

Ikan batu, or Ikan pichat priuk, of the Malays.

*Young.* Head and body blackish brown, light reddish brown, or brownish green, either uniformly or with large blotches of a lighter or darker shade; soft portion of dorsal and anal fin like the body, membrane black; caudal like the body, black towards the yellowish white margin, membrane of the dorsal and anal spines and ventrals brownish or greenish grey, tinged with orange; pectorals yellowish white.

*Adult.* Brownish lilac or mulberry coloured, either uniformly, or with large blotches of silvery grey; the scales either of the ground colour with silvery grey edge, or vice versa; pectorals yellowish white; soft portion of dorsal and anal, and the caudal like the body, their terminal half bluish or greenish black; membrane of dorsal and anal spines light brown or grey marbled with blackish; ventrals dark bluish grey; throat, inter- and preopercle silvery grey. Iris silvery of the ground colour of the body.

D 12/15, C 17½, A 3/12 or 11, V 1/5, P 15 or 16, Br. VI.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Java, Madura, Malabar, Ceylon, Bay of Bengal, Estuaries of the Ganges.

TOTAL LENGTH: 2 feet 5 inch.

The young differs from the adult in having the margin of the caudal fin or its posterior third, yellowish white, and in having comparatively fewer but much larger teeth or spines on the margin of the preopercle, particularly towards the rounded angle. As the latter is the principal distinguishing character assigned to *L. farkarii*, Cuv. and Val. it is

probable that Colonel Farquhar's drawing, upon which the description is founded represents a young individual of *L. erate*. Single individuals weighing upwards of 15 lbs, occur at Pinang at all seasons, and are dried by the natives. The air-vessel is very large, about  $\frac{1}{3}$  of the total length, silvery white and of a lanceolate shape. It is excessively thin, and so firmly adhering to the back, that but a small part can be removed. The isinglass is by the Chinese dealers considered to be of good quality, but the small quantity procurable renders the fish less valuable in this respect.

GEN. *SCOLOPSIS*, Cuvier, 1817.

(*SCOLOPSIDES*, Telfair, 1830.)

The second infraorbital bone terminating in a rounded lobe, generally toothed, with a backwards directed spine at the angle adjoining the orbit; third infraorbital with a forwards directed spine, in some hid in the skin, crossing the former; preopercle toothed; submaxillary pores either absent or very minute; body oval or oblong with large scales; dorsal fin single; mouth moderate; teeth velvety; branchiostegous rays five.

*SCOLOPSIS AURATA*, (Mungo Park.)

*Perca aurata*, Mungo Park: Tr. Linn. Soc. III. 35.

*Anthias vosmeri*, Bloch, Pl. 321.

*Lutjanus vosmeri*, Lacépède, IV. 213.

*Lutjan galon-d'or*, Lacép. IV. 216.

*Pomacentrus enneadactylus*, Lacép. IV. 505, 508.

*Scolopsides vosmeri*, Cuv. R. A. II. 178<sup>(1.)</sup>

*Scolopsis argyrosomus*, Kuhl and Van Hasselt, Cuv. and Val. V. 333.

*Scolopsides vosmeri*, Cuv. and Val. V. 333.

Head above red; back pale bluish green; sides light red with two indistinct mother-of-pearl coloured longitudinal bands above the lateral line, beneath which a third broader and distincter, terminating opposite the soft dorsal fin; cheeks, opercles and abdomen reddish white; infraorbitals greenish golden; all the scales, the infraorbitals, preopercle and opercle with vermilion edges; membrane of dorsal, anal and ventrals whitish transparent, spines and rays vermilion; caudal and pectoral membrane and rays pale vermilion. Iris reddish golden.

D 10/9, C 17 $\frac{3}{4}$ , A 3/7 or 8 V 1/5 P 19, Br. V.

**HABIT.**—*Sea of Pinang.*

Java, Sumatra.

**TOTAL LENGTH :**  $7\frac{1}{2}$  inch.

The eye occupies the second third of the length of the head, which, when the muzzle is protracted, is  $\frac{1}{4}$  of the total length. The greatest vertical diameter of the body is contained about  $2\frac{1}{2}$  times in the total length; the series of scales forming the lateral line are much smaller than the rest and of a triangular shape; the upper lobe of the caudal is somewhat longer than the inferior; the length of the anterior anal spine is one half of the second, which is as long as the pectoral spine, but much thicker. The cheeks are concave, and the ascending margin of the preopercle is salient, diverging from the opercle, its teeth distant, bent outwards, but generally pointing backwards. Most of the teeth have at the base a minute downwards pointed spine, which may be perceived by passing a finger from below upwards along the margin. The spine of the first infraorbital is long, bayonet-shaped; beneath it appear two or three smaller; these, the margin of the infraorbitals, preopercle, opercle, the spines and rays of the dorsal, anal and ventral fins, as well as the upper and lower margin of the caudal appear as if they were lackered with vermilion. Two individuals of nearly equal length were observed at Pinang in May and July 1845.

#### FAM. ANABANTIDÆ.

**GEN. ANABAS**, Cuvier, 1817.

Head rounded, broad; muzzle very short, obtuse, more or less depressed; the eye near the muzzle; mouth small; velvety teeth in both jaws; a small transversal band of similar teeth on the anterior, and a few on the posterior part of vomer between the third upper pharyngeals; margins of opercle, subopercle and interopercle strongly toothed; branchiostegous rays six.

**ANABAS SCANDENS**, (Daldorf.)

*Perca scandens*, Daldorf: Linn. Tr. III. 62.

*Anthias testudineus*, Bloch, Pl. 322.

*Lutjan tortue*, Lacépède IV. 192, 235.

*Lutjan grimpeur*, Lacépède, l. c. 195, 239.

*Amphiprion testudineus et scansor*, Bloch-Schneider, 204.

*Cephalopholis*, id. 570.

*Sparus testudineus*, Shaw, IV. 471.

*Anabas scandens*, Cuv. R. A. (1817). II. 340.

*Coius cobojus*, Buchanan Hamilton, 98, 370, Pl. 13, Fig. 33.

*Anabas testudineus*, Cuvier, R. A. (1829) II. 226.

*Anabas scandens*, Cuv. and Val. VII. 325, Pl. 193.

(Icon.) *Anabas spinosus*, Gray : Ill. Ind. Zool. II. Pl. 89, Fig. 1.

*Anabas scandens*, Swainson, II. 237.

*Anabas scandens*, Cantor : Ann. Nat. Hist. IX. 28.

*Anabas scandens*, Richardson : Rep. 1845, 250.

*Anabas scandens*, Jerdon : Madras Journal, XV. 144.

*Anabas scandens*, Bleeker : Verh. Bat. Gen. XXII. 4.

Haroon of the Malays.

*Adult.* Head above and back dark green, lighter on the sides, abdomen greenish silvery ; the membrane between the two largest opercular spines black, forming a rounded spot ; dorsal and anal spines and membranes pale greenish lilac, minutely dotted with brown ; soft part of dorsal and anal, as well as caudal fin greenish grey. Iris narrow golden round the pupil ; the rest golden brown, amber, or pale crimson ; the upper half of the orbital margin green bronze.

*Young.* Body and the single fins of much lighter colour ; at the centre of the root of the caudal a large round black spot ; ventral and pectoral rays reddish yellow or pale orange, their membranes transparent whitish.

D 18 or 19/9 or 10, C 16 $\frac{3}{4}$ , A 10/10 or 11, V 1/5, P 15, Br. VI.

HABIT.—*Fresh water and estuaries Malayan Peninsula and Islands.*

Fresh water and estuaries Chusan, Celebes, Java, Madura, Sumatra, Burmah, Tenasserim, Bengal, Assam, Coromandel, Philippines.

TOTAL LENGTH : 7 inch.

At Pinang and Singapore this species is less numerous than in Bengal, and in the former localities large individuals are of comparatively rare occurrence. The Malayan individuals agree with the Bengal ones in most of the external characters : the length of the head is  $\frac{1}{3}$  of the body, the caudal fin not included ; the diameter of the eye is  $\frac{1}{3}$  of the length of the head. But the caudal fin is comparatively longer varying from  $\frac{1}{4}$  to  $\frac{1}{3}$  less than the length of the head ; the dorsal and anal spines are longer, the ventral rays reach the first anal spine ; the greatest

vertical diameter of the body varies from  $\frac{1}{4}$  to somewhat less than  $\frac{1}{4}$  of the total length. Individuals taken in Bengal have the caudal fin  $\frac{2}{3}$  of the length of the head; the greatest vertical diameter of the body slightly exceeds the length of the head. The colours are slightly different and the number of fin rays are,

D 16 or 17/9 or 10, A 10 or 11/10.

In the Malayan countries the fish is eaten by the poorer classes, who, however, attribute to it neither the medicinal qualities nor the climbing propensities, for which it is famed by the natives of Bengal.

GEN. MACROPODUS, *Lacépède*, 1802.

Velvety teeth in both jaws, with an external series of longer, distant, recurved teeth; margins of infraorbitals and opercles externally smooth; lateral line, when present, interrupted; dorsal and anal rays undivided; dorsal fin of less extent than anal; first ventral and some of the posterior anal rays elongated, filamentous.

MACROPODUS PUGNAX, Cantor.

Plate II. Figs. 1, 2, 3.

Head above and back pale brownish or olive grey, lighter on the opercles, sides and abdomen; from between the eyes along the back 8 to 11 blackish vertical bands, reaching the abdomen; along the sides 5 or 6 longitudinal silvery lines, produced by a silvery dot on each of scale; from the angle of the mouth, through the iris to the termination of the opercle a horizontal black band; lips, chin, and throat blackish blue spreading as a horizontal band over the lower part of the side of the head to the gill-opening; dorsal, caudal and ventral membranes pale reddish hemitransparent; margin of the dorsal and the filamentous anterior ventral ray pale golden or silvery green; anal membrane pale Indian red, lower margin silvery bluish or greenish; rays blackish; pectorals whitish transparent. Iris narrow, golden; the half below the black transversal band carmine; the half above the band golden, and near the orbit dark olive.

D  $1\frac{1}{8}$  or 9, C  $13\frac{1}{4}$ , A  $2\frac{2}{25}$  or 26, V  $1\frac{1}{5}$ , P 13, Br. VI.

HABIT.—*Fresh water, Pinang, Malayan Peninsula.*

TOTAL LENGTH:  $3\frac{1}{4}$  inch.

The head is much depressed, and far broader than the body, which is gradually compressed towards the caudal fin. The profile of the



back is slightly arched, the highest part being at the dorsal spine; the abdominal profile is less arched than the former. The length of the head is  $\frac{1}{3}$ , or slightly more, of the length of the body, the caudal not included; the depth at the occiput  $\frac{1}{3}$  of the length of the head. The eyes are prominent, occupying the second fourth, and bordering on the profile. Their distance across the forehead is nearly double the diameter. The mouth is semicircular, moderate; the angle is in front of the orbit. The posterior opening of the nostrils is situated close to the orbit; the anterior is provided with a small fleshy tube. The tongue is free, fleshy and very pointed. Behind the velvety teeth of the upper jaw appear successively three semicircular membranous folds, of which the posterior is papillular on the margin, which thus appears as if studded with a second series of minute teeth. The head is everywhere covered with large rounded scales like the rest of the body, but the slightly protractile jaws are naked; the posterior part of each branch of the lower jaw is covered by a single large oval scale. The greatest vertical diameter of the body, at the dorsal spine, is in some individuals  $\frac{1}{2}$  of, in others equal the length of the head. The vertical diameter at the root of the caudal fin varies from  $5\frac{1}{2}$  to  $\frac{1}{2}$  of the length of the body. The dorsal fin commences a little behind the posterior half of the body; the rays gradually increase towards the fifth, the longest; the extent of the base is from  $\frac{1}{3}$  to  $\frac{1}{2}$  of the length of the body; the distance from the last ray to the caudal is  $\frac{1}{4}$  of the length of the body. The caudal is very broad lanceolate; the two central rays are the longest, in some individuals  $\frac{1}{3}$  of the entire length of the fish, but frequently less. The length of the anterior filamentous ventral ray rarely exceeds that of the head. The pectorals are rounded, their length but slightly exceeds  $\frac{1}{2}$  of the head. Opposite their posterior half is situated the anus, immediately behind which the anal fin commences. The rays of the latter gradually increase in length to the twenty-third or fourth, which are sometimes elongated beyond the point of the caudal fin. The extent of the scaly base of the anal equals  $\frac{1}{2}$  of the length of the body. No lateral line appears, but on the series it would occupy if present, some of the anterior scales have each a central rounded depression, which, however, also appears on single scales nearer the back. Three series lower down, on the posterior half of the sides, commences sometimes a row of similar depressions, which then continue to the caudal

fin. The scales are rather large, higher than long; the anterior margin is straight with 21 striae, the posterior rounded, ciliate; a line from the gill-opening to the caudal fin contains 32; the greatest vertical diameter presents 10. Of the six branchiostegous rays the upper one is longer and broader than the rest; the fifth and sixth are rounded, setaceous. Esophagus is voluminous, short, suddenly widening into the rounded capacious stomach. The intestinal canal is doubled upon itself, about  $\frac{1}{3}$  of the length of the fish. Neither caecopyloric appendages nor air-vessel appear. The liver is elongated of a reddish yellow. The skeleton has 28 vertebrae of which 10 are abdominal. The branchial labyrinth (Plate II. Fig. 2.) is still more reduced than it is in *Macropodus viridi-auratus*, Lacép. and almost as simple as in *Spirobranchus capensis*, Cuv. (Cuv. Val. VII. 392, Pla. 200 and 205.) It consists of a single backwards bent lamina, and a very small posterior rudimentary one. At the foot of the hills at Pinang this species is numerous in rivulets. Like the rest of the family it is capable of living for sometime out of water. The Siamese inhabitants with whom this species is a great favourite, keep these fishes in jars with water, where the larva of mosquitoes is their food, and denominate them "*Pla kat*,"\* i. e. the fighting fish, although they live peaceably together. The real fish however, the exhibition of whose combats is a popular amusement with the Siamese, appears to be a variety of the present species, produced by artificial means, like the varieties of the golden carp of China.

#### MACROPODUS PUGNAX, VAR.

##### Plate II. Fig. 4.

##### Pla kat of the Siamese.

Head above and back dark greenish olive, lighter on the sides, the lower part of which and the abdomen deep blood red; all the scales edged with black; a black longitudinal band from the eye to behind the dorsal fin, a second from the nostrils, through the iris to the root of the caudal; a third from below the eye obliquely downwards to the gill-opening; dorsal membrane silvery greenish brown, with numerous black undulating lines, vertically intersecting the black rays; caudal

\* *Pla*, fish; *kat*, a fighter. The Variety is noticed by Lieut. Colonel Jas. Low.

membrane golden green, the rays bright blood red, the fin edged with black; anal membrane bright blood red as far as the posterior 4 or 5 rays, the rest as well as the lower margin silvery light green or sky-blue, the rays black; ventral spine and rays black, the first ray terminating in a silvery filament; the membrane between the first, second and third ray bright blood red, the rest black; branchiostegous rays and their very wide membrane black; pectorals white, transparent. Iris pale reddish golden with a bluish black spot in the centre of the lower half.

The number of fin rays, and other external characters are the same as in the species, but the colours and the length of the dorsal, caudal, anal and ventral fins are individually varying. The branchiostegous membrane is remarkably wide and lax. When the fish is in a state of quiet with the fins at rest, the dull colours present nothing remarkable. But if two are brought within sight of each other, or if one sees its own image in a looking glass, the little creature becomes suddenly excited, the raised fins and the whole body shine with metallic colours of dazzling beauty, while the projected gill membrane, waving like a black frill round the throat, adds something grotesque to the general appearance. In this state it makes repeated darts at its real or reflected antagonist. But both when taken out of each other's sight, instantly become quiet. The description was drawn up in 1840 at Singapore, where a gentleman had been presented with several by the King of Siam. They were kept singly in glasses with water, fed with larvas of mosquitoes, and had thus lived for many months. The Siamese are as infatuated with the combats of these fishes as the Malays are with their cock fights, and stake considerable sums, and sometimes their own persons and their families. The license of exhibiting fish fights is farmed, and affords a considerable annual revenue to the King of Siam.

GEN. *OSPHEOMENUS*, (Commerson) Cuvier, 1829

(*OSPHEONEMUS* [Comm.] Lacépède, 1800.)

Differs from *Polyacanthus*, Kuhl and Van Hasselt, by the shorter extent of the dorsal fin, by the more complicated labyrinthform (super-branchial) organ, by the very elongated, setaceous first ventral ray, and by the toothed margin of the infraorbitals. In the young the margin of pre- and interopercle are toothed.

## OSPHROMENUS OLFAX, Commerson.

*Osphronème gourami*, Lacépède, III. 117, Pl. 3, Fig. 2.

*Trichopus goramy*, Shaw, IV. 388, Pl. 55.

*Trichopus satyrus*, Shaw, l. c. 391, Pl. 35?

*Osphronemus olfax*, Hardwicke: Zool. Journ. Vol. IV. 309.

*Osphromenus olfax*, Cuvier, B. A. II. 228.

*Osphromenus olfax*, Cuv. and Val. VII. 377, Pl. 198.

*Osphromenus notatus*, Kuhl and Van Hasselt. (*Young?*)

Cuv. and Val. VII. 386.

*Osphromenus olfax*, Swainson, II. 236.

*Osphromenus olfax*, Richardson: Rep. 1845, 251.

*Osphronemus olfax*, Bleeker: Verh. Bat. Gen. XXII. 4.

*Ikan gorámmi*, of the Malaya.

*Young.* Head above and back dark brown or olive, lighter greenish on the sides of the head and body to a little above or below the lateral line; lower parts of the sides of head and body, and abdomen silvery brownish or reddish buff; from the occiput to the caudal 7 to 9 oblique blackish bands; at the root of the pectorals, and in the penultimate lateral band, a little in front of the termination of the anal, a black spot; pectorals and posterior half of ventrals whitish, the rest and the membranes of the other fins closely and minutely dotted with brown; spines and rays brownish grey.

*Adult.* Head, back and upper part of the sides reddish or greenish dark brown; opercles and lower half of the sides impure yellowish white; lateral bands very indistinct; fins greyish brown, ventrals and pectorals paler than the rest. Iris reddish golden with scattered black spots.

D  $\begin{cases} 11/11, \\ 12/12, \\ 13/12, \end{cases}$  C 16½, A  $\begin{cases} 9/21, \\ 10/20, \\ 11/19, \\ 12/20, \end{cases}$  V 1½, P 15, Br. VI.

HABIT.—(*Naturalised*) *Fresh water, Pinang, Malacca.*

*China, Java, Madura. (Naturalised) Isle of France, Cayenne.*

TOTAL LENGTH: 1 foot 6 inch.

The very young individuals differ from the adult not only in colours, but also in having the head more elongated: its length being from 2½ to 2⅔ in that of the body, the caudal not included. In the adult the head is 3¼ in the body alone, the toothed margin of the pre- and inter-opercle becomes smooth, and the first ventral ray is comparatively

shorter than in the young, in which it sometimes reaches the caudal fin. Both at Pinang and at Malacca this fish has been successfully naturalised though in the former place it is not numerous, but confined to a few ponds. They become tame so as to appear on the approach of their feeder, and will rise to flies, beetles, and certain flowers, particularly a large *Hibiscus*. Among themselves they are pugnacious. Many years ago several living ones were imported, and placed in a tank in the Calcutta Botanical Gardens, where they appeared to thrive. Little care, however, having been bestowed on their preservation, but a solitary one survived in 1841.

GENUS. *TRICHOPODUS*, Lacépède, 1800.

Scarcely differs from *Osphromenus* but by a more convex forehead, and by a dorsal fin of less extent.\*

*TRICHOPODUS TRICHOPTERUS*, (Pallas.)

Plate II. Fig. 5. (Head.)

Sparus, Koelreuter. Nov. Comm. Petrop. IX. P. 452, Pl. 9,

*Labrus trichopterus*, Pallas : Spicil. Fasc. 8, 45. [Fig. 1.

*Labrus trichopterus*, Linné : Syst. 1286.

*Trichopode trichoptère*, Lacépède, III. 129.

*Trichogaster trichopterus*, Bloch-Schneider, Pl. 295, Fig. 2.

*Trichopus pallasii*, Shaw, IV. 392.

*Trichopus trichopterus*, { Cuvier, R. A. II. 229 (1.)  
                                  { Cuv. and Val. VII. 388, Pl. 199.

*Trichopus maculatus*, Swainson, II. 235.

*Trichopus trichopterus*, Bleeker : Verh. Batav. Gen. XXII. 4.

Head above, back and sides to a little below the lateral line brownish olive, each scale of the latter with a sky-blue or verdigris rectangular spot; cheeks and opercles silvery light blue with lilac reflection; sides below the lateral line silvery light blue, abdomen silvery reddish lilac, all the scales iridescent, edged with reddish brown forming an irregular network; from the angle of the mouth through the iris, below the silvery lateral line to the root of the caudal a black zig-zag band, widening at the termination into a large spot, and in some individuals a similar in the centre part of the band; dorsal spines and rays whitish grey, their membrane dark grey with numerous white rounded spots;

\* Although to these differences may be added a less complicated labyrinthiform organ, and five branchiostegous rays, the genus rests but on slender characters.

caudal membrane and rays like the dorsal; anal spines carmine, their membrane and rays whitish, each ray terminating in a short silvery filament; ventral spine, membrane and four rays whitish, the anterior elongated ray carmine; pectoral pale carmine at the root, the rest white transparent. Iris narrow golden round the pupil, lower half sky-blue, upper half above the black bar golden brown.

$$D \begin{cases} 6/9, \\ 7/8, \\ 7/9, \\ 7/10, \end{cases} C \ 16\frac{1}{2}, A \begin{cases} 10/34, \\ 12/29, \\ 13/29, \\ 14/28, \end{cases} V \ 1/5, P \ 9, Br. \ V.$$

HABIT.—*Fresh water, Pinang, Malayan Peninsula.*

Moluccas, Madura, Java.

TOTAL LENGTH:  $4\frac{1}{2}$  inch.

Like all the species of this family, the present is liable to considerable individual variations of colours, number of fin rays and proportions. Thus M. M. Cuvier and Valenciennes count:

D 5/8, C 16, A  $11/35$  or 36, V 5, P 14, Br. IV.

and ask with doubt if the species be different which Bloch characterises:

D 7/7, C 16, A  $11/33$ , V 3, P 10, Br. IV.

With regard to the number of branchiostegous rays, it is *five* on each side; the superior is the longest and broadest, the rest gradually decrease in length and breadth. They are difficult to count as the second is completely hid under the first, and the fourth and fifth are very thin, setaceous, and may thus easily be mistaken for a single one. The ventral spine is very short, and thick, but so firmly adhering to the root of the first elongated ray, that it easily escapes observation. The short, gradually decreasing 2d, 3d, 4th, and 5th ray are divided, but the latter is frequently undivided. The length of the head varies in individuals of equal length from  $3\frac{1}{2}$  to  $3\frac{3}{4}$  in that the body, the caudal fin not included. The latter is a little shorter than the head, the vertical diameter of which, at the occiput, equals the length. The diameter of the eyes is  $3\frac{1}{2}$  times in the length of the head; their distance across the forehead is  $1\frac{1}{2}$  diameter. The anterior smaller opening of the nostrils has a short membranous tube. The mouth is small and rendered more so as the lower jaw forms a much smaller half circle than the upper. Both have a narrow band of velvety teeth. The tongue is small, fleshy, and its margin completely adhering to the floor of the mouth. The greatest vertical diameter of the body at the fourth dorsal spine varies from  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in the length of the body, the

caudal fin not included. The distance from the last dorsal fin to the upper caudal appears to be constantly equal the length of the head. The longest dorsal, caudal and anal rays seldom exceed the length of the head, but are frequently a little shorter. The first ventral ray in some reaches the termination of the anal, in others beyond that of the caudal. The anal rays are either all undivided or a few of the posterior are divided, and the last connected to the caudal. The length of the pectoral is  $\frac{3}{4}$  of that of the head. The lateral line consists on each scale of a central transversal tube, above and below which appears a short elongated furrow. A straight line from the gill-opening to the root of the caudal contains from 44 to 46 scales; a vertical at the deepest part of the body from 20 to 25. The lower margin of the infraorbitals and of the preopercle are closely and rather strongly toothed. The stomach is rounded, contracted in the middle, and as well as the spirally twisted intestines almost entirely hid by the large light brown liver. There are two rather long cœcopyloric appendages. The gall-bladder is rather large, the spleen small. Between the vertebral column and the abdominal cavity appears a very short air-vessel, silvery like the peritoneum, but much thinner. The intestinal canal is nearly double the length of the fish. The labyrinth-form organ (Plate II. Fig. 5,) is less complicated than in *Osphromenus olfax*: it consists of three laminae of which the central is the largest, entirely hiding the third, the inner one. Like the rest of the family, this species is capable of sustaining life out of water, particularly if kept in wetted fresh leaves, or occasionally sprinkled with water. At Pinang it is numerous in streamlets and ponds, where it is eaten by the poorest classes. The exquisite beauty of the metallic iridescent colours make these fishes acquisitions in garden tanks. Like *Osphromenus olfax* they are very pugnacious among themselves.

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A second species of *Trichopodus* has been discovered by Mr. Campbell, Superintendent of Darjeeling, in the rivers at the Sikkim passes on the northern frontier of Bengal. An incorrect and defective description and figure have been published by Mr. McClelland, who imagining the fish to belong to the Family of *Chaetodontidae*, and the genus to be new, denominated it *Ctenops nobilis*.\*

\* Cal. Journ. Nat. Hist. V. 281, Pl. 21, Fig. 1.

GEN. *OPHIOCEPHALUS*, *Bloch-Schneider*, 1801.

With labyrinth-form superbranchial organ; fins without spines, the ventrals commencing with a divided or undivided, jointed ray; dorsal occupying nearly the whole length of the back; caudal rounded; lateral line uninterrupted; head depressed, covered with polygonal scales; both jaws, vomer and palatal bones with velvety, or card-like teeth, among which generally some longer than the rest; body elongated, almost cylindrical. Branchiostegous rays five.

*OPHIOCEPHALUS STRIATUS*, Bloch.

*Ophicephalus striatus*, Bloch, Pl. 359.

*Ophicephalus wrahl*, Lacépède, III. 552.

*Ophicephalus striatus*, Shaw, IV. 530.

Russell, CLXII. Muttah.

*Ophicephalus wrahl*? Buch. Ham. ("Sol.") 60, 367, Pl. 31, Fig. 17.

*Ophicephalus chena*, Buch. Ham. (*Var.*) 62, 367.

*Ophicephalus striatus*, Cuv. R. A. II. 230 (\*)

*Ophicephalus striatus*, Cuv. and Val. VII. 417, Pl. 202.

*Ophicephalus striatus*, Swainson, II. 237.

*Ophicephalus wrahl*, McClelland, Cal. Journ. Nat. Hist. II. 575.

*Ophicephalus striatus*, Jerdon, Madr. Journ, XV. 146.

*Ikan harian* of the Malays.

Head above and back greenish olive with indistinct clouded black spots; cheeks, opercles and sides to a little beneath the lateral line lighter with metallic lustre; throat, abdomen and lower part of the head and sides white; from the angle of the mouth a short metallic-olive oblique line, and on the throat a few distant dark spots; lower part of sides with a number of backwards directed oblique, blackish lines, the intervals between which pale salmon-coloured; dorsal membrane minutely dotted with brown so as to produce oblique brownish lines, between which, at the base, appear some rounded whitish spots; caudal pale brownish with indistinct light concentric lines; upper half of anal white with oblique brown lines; lower half blackish brown; ventrals white with indistinct blackish spots; pectorals transparent whitish, minutely dotted with brown along the margins of the rays.



Iris amber-coloured, orange or reddish golden round the pupil, the rest golden olive, clouded with black.

D 41, 42 or 43, C 14½, A 25, 26 or 27, V 6, P 16 or 17, Br. V.

HABIT.—*Freshwater and estuaries, Malayan Peninsula and Islands.*

Manilla, Celebes, Tenasserim, Rangoon, Irawaddy, Ganges, Bengal, Barrampootr, Goalparah, Coromandel, Malabar, Hindostan.

TOTAL LENGTH : 2 feet.

The length of the head is from  $3\frac{1}{4}$  to  $3\frac{1}{2}$  in the total ; (it is  $\frac{1}{2}$  of the distance from the muzzle to the last dorsal ray ;) the height at the occiput is  $2\frac{1}{2}$  in the length. The horizontal diameter of the eyes slightly exceeds  $\frac{1}{2}$  of the length of the head ; their distance across the forehead equals two such diameters. The vertical diameter at the first dorsal ray is  $\frac{1}{2}$  of the length of the head. The anterior part of the lateral line gradually descends towards the commencement of the second third of the dorsal, from whence it proceeds straight to the root of the caudal. The line is marked on each scale by a short central tube, which bifurcates. The number of component scales vary from 60 to 62. An oblique series from the anus consists of 18 to 20 scales. In these and other characters the Malayan individuals exactly correspond to *O. striatus*, Bloch, as described by M. M. Cuvier and Valenciennes. Individuals of *O. wrahi?* apud Buchanan Hamilton, (*Sol.*) taken in the vicinity of Calcutta, differ but slightly in colours, and in presenting from 43 to 46 dorsal, and from 26 to 28 anal rays. *O. cline*, Buch. Ham. offers the same number of rays as the latter, and appears but to be another variety, probably as Buchanan suggests, the identical one which Russell figured No. CLXII. *Muttah*. In the Malayan countries, the fish is as numerous as in Bengal, and it is also there eaten by the natives.

#### FAM. MUGILISIDÆ.

GEN. MUGIL, (*Artedi*,) *Linæ*, 1748.

Body nearly cylindrical, covered with large scales ; two dorsal fins widely separated : the anterior spinous, the posterior with one or two spines, the rest rays ; ventrals behind the pectorals ; centre of the lower jaw with an elongated angular point, corresponding to a notch in the upper jaw ; teeth minute. Branchiostegous rays six.

## MUGIL PARMATUS, Cantor.

*Young?* Head above and back pale brownish olive; cheeks and upper half of the sides silvery greenish grey; lower half of the sides and abdomen silvery white; on the upper part of preopercle a triangular bluish black spot, behind which an indistinct amber-coloured spot; the rest of preopercle and opercle pale silvery blue, faintly vermiculated with brown; dorsal and caudal membranes pale grey, minutely dotted with brown; the rest of the fins white. Iris silvery grey.

D 4— $1\frac{1}{8}$ , C 14  $\frac{1}{7}$ , A  $3\frac{3}{9}$ , V  $1\frac{1}{5}$ , P 14, Br. VI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH:  $4\frac{5}{8}$  inch.

The length of the head is  $4\frac{3}{8}$  in the total, or  $\frac{1}{4}$  of the length of the body, the caudal not included; the height at the occiput  $\frac{1}{4}$  of the length of the head. The orbit occupies the second fourth of the head; the eye is covered in front and behind by a crescent-shaped adipose lobe; the distance of the orbits across the forehead equals  $1\frac{1}{2}$  diameters. On the anterior margin of the infraorbital bone appears a broad angular incision, which receives the angle of the lips; the inferior margin is truncated, minutely toothed; near the upper margin of the infraorbital, below the two small openings of the nostrils, appear two minute pores. The mouth is very small; both jaws have excessively minute setaceous teeth, scarcely projecting beyond the cartilaginous lips. The greatest vertical diameter of the body, in front of the anterior dorsal spine, equals the length of the head; that in front of the caudal fin is  $\frac{1}{2}$  of the former. A straight line from the gill-opening to the caudal contains 27 scales, an oblique series 10. The anterior dorsal spine is strong: its length is a little less than  $\frac{2}{3}$  of that of the head; no elongated triangular scale appears at the base of the anterior dorsal, nor of the pectoral. The second dorsal, the caudal and anal fins are half covered with very small scales. The first anal spine is excessively minute. The two central rays of the caudal are but very slightly shorter than the rest. A single individual was observed at Pinang in April 1844.

The present greatly resembles *M. grandisquamis*, Cuv. and Val. (XI. 103), an African species, remarkable for the great size of its scales. The latter differs in the following particulars. The greatest height is nearly  $\frac{1}{4}$  of the total length; at the occiput the height is  $\frac{1}{3}$  of the

length of the head; at the root of the caudal it is one half of the greatest. It is described as having no teeth.

**MUGIL MACROLEPIDOTUS**, Rüppell.

*Muge christian*, Quoy et Gaimard : Voy. de Freycinet.

*Mugil macrolepidotus*, Rüppell : Atlas, Fische, p. 140, Taf. 32, Fig. 2.

*Mugil macrolepidotus*, Cuv. and Val. XI. 134.

*Mugil macrolepidotus*, Richardson : Report, 1845, 249.

*Young.* Head above and back pale bluish green; lighter, silvery, on the sides of the head and abdomen; opercle steel blue; on the sides four parallel pale blackish lines; dorsal, caudal, and anal spines, rays, and membranes minutely dotted with black; on the dorsals and anal so closely as to give the marginal half a black appearance; ventrals white, posterior half of the three anterior rays minutely dotted with black; upper ten pectoral rays black, the rest white. Iris silvery.

D 4—1/8, C 14  $\frac{1}{4}$ , A 3/8, V 1/5, P 16, Br. VI.

**HABIT.**—*Sea of Pinang.*

Waigiu, Rawak, Borabora, Vanikolo isles, Malabar, Red Sea, China Seas?

**TOTAL LENGTH** : 5 inch.

The length of the head is  $4\frac{1}{4}$  in the total; the height at occiput  $\frac{3}{4}$  of the length. The diameter of the eyes is  $3\frac{1}{4}$  in the length of the head; their distance across the forehead equals two diameters. The anterior margin of the infraorbital bone is arched, so as to receive the angle of the lips, and as well as the inferior truncated margin finely toothed. The young has no perceptible teeth; M. M. Cuvier and Valenciennes describe them as short and fine in the adult. The posterior margin of the preopercle has three deep indentations. The vertical diameter in front of the first dorsal spine slightly exceeds  $\frac{1}{4}$  of the total length; that in front of the caudal fin is less than one half of the former. A straight line between the gill-opening and the root of the caudal contains 29 scales; an oblique series in front of the anterior dorsal fin 9. The first dorsal spine is scarcely  $\frac{1}{4}$  of the length of the head, and less strong than in *M. parmatius*. A single individual was observed at Pinang in August, 1843.

**MUGIL CEPHALOTUS**, Cuv. and Val.

*Mugil our*, Forskål, Consp. p. XIV. No. 109, Var. 8?

*Mugil cephalus*, Russell CLXXX. Bontah.

*Mugil cephalus*? (*Sole bhanggan*), Buchan. Ham. p. 219, 381.

Bontah, Russell. (Syn.—*Mugil oür*, Forsk.) Cuvier R. A. II. p. 232 (?).

*Mugil cephalotus*, Cuv. and Val. (Syn.—*Mugil oür*, Forsk.) XI. 110.

Russel II. CLXXX. Rüppel: *Neue Wirbelth. Fische*, p. 131.

*Mugil cephalotus*, Bleeker, Verh. Bat. Gen. XXII. 5.

Júmpul of the Malays.

Head above and back lead-coloured tinged with green, lighter silvery on the sides of the head and body as far as the upper margin of the pectoral fins; all the parts below dull silvery white; on the sides five to seven parallel, dark grey longitudinal bands; anterior dorsal fin light bluish grey; posterior and caudal membrane dark grey, rays lighter; anal and ventrals white; pectorals outside white, hemitransparent, inside with a large oblique blackish spot on the anterior half. Iris silvery or mother-of-pearl round the pupil; the rest blackish brown.

D 4—1/8, C/14½, A 3/9, V 1/5, P 17, Br. VI. [Isles.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore, Lencay Chusan, Macao, Madeira, Coromandel, Bay of Bengal, Gangetic estuaries, Malabar.*

TOTAL LENGTH: 2 ft.

The head is much depressed, broad oval, the muzzle being about half the breadth of the occiput. The upper surface is less transversely arched than the lower; both surfaces where they join, form a blunt ridge from behind the eye to the short triangular membranous point in which the opercle terminates. The eye is situated in front of the ridge, occupying the third eighth of the head; its transversal diameter being  $\frac{1}{2}$  of the length of the head, which is  $4\frac{1}{2}$  times in the total, or  $\frac{1}{4}$  of the body, the caudal fin not included. The distance between the eyes across the forehead equals  $3\frac{1}{2}$  diameters. The vertical diameter of the head between the eyes is about  $\frac{1}{2}$  of the length: at the occiput it is  $\frac{1}{4}$ . The openings of the nostrils are situated a little above the level of the orbit, along the superior margin of the infraorbital; the posterior, the larger, is transversely oval; the anterior is circular. The infraorbital bone is broad triangular, with

the rounded, truncated apex downwards; the latter, as well as the backwards arched anterior margin, is finely but distinctly toothed, and naked, but the rest of the external surface is covered with small scales. The adipose membrane covering the circumference of the eye is of a whitish grey. No such series of pores appear on the lower half of the membrane, as *M. Rüppell* has observed in *Mugil our*, Forskål (not apud Cuvier and Val.), nor are there any pores under the lower jaw. The lower half of the posterior margin of the preopercle has two large, a little obliquely upwards-directed indentations, and in some the upper half of the margin has two similar ones. *M. our* as well as *M. cephalus* are according to *M. Rüppell* distinguished by six pores beneath the lower jaw, and by three not very distinct oblique indentations in the lower margin of the preoperculum. The mouth is horizontal, the angle is opposite the anterior opening of the nostril; the upper jaw projects beyond the lower. The upper mandible is flattened, broad in the centre, tapering towards the angles of the mouth; in the centre is a very small notch. In the upper lip appears a single series of very minute teeth. The symphysis of the lower jaw forms a tubercle under which appears a notch deeper than that of the centre of the upper mandible. The lower lip is more fleshy than the upper, and the margin is bent downwards, so as to form on each side a furrow proceeding from the notch under the symphysis to the angle of the mouth. The teeth of the lower jaw are so excessively minute, few, and distant, that even in large individuals they are imperceptible to the touch, and can only be seen through a lens. In smaller individuals these teeth are absent, or at least confined within the half transparent mandibles, and appear like short seta, bent with the lip, but not projecting beyond it. The tongue is fleshy, broad at the root, narrower, rounded at the apex, and raised in a keel in the centre. Along the margin which is fixed to the floor of the mouth, appears a series of rounded or oval patches of velvety teeth. At the root of the central keel is an elongated patch, and close behind the apex two smaller ones of velvety teeth. On each side of the vomer is raised into a tubercle, carrying a transverse-placed linear patch of similar teeth. Every part of the head is covered with scales, of which those of the opercle are very large, but in young individuals they are so thin as to make the silvery opercle appear scaleless. The vertical diameter in front of the anterior dorsal spine

equals the length of the head minus the diameter of the eye. The anterior dorsal spine equals the distance from the muzzle to the posterior margin of the orbit, or about  $\frac{1}{2}$  of the last mentioned vertical diameter. The anterior dorsal fin commences in the centre of the distance between the muzzle and the root of the caudal. The extent of the base equals the length of the anterior spine; from its centre commences an elongated, triangular scale, projecting midway behind the very slender fourth spine, the length of which is  $\frac{1}{2}$  of the preceding three. The distance between the anterior and posterior dorsals equals  $\frac{1}{2}$  of the length of the head, the latter fin commencing opposite the centre of the anal, much nearer the caudal than the anterior dorsal. The anterior ray equals  $\frac{1}{2}$  the length of the head. The distance between the posterior ray and the root of the caudal equals the length of the anterior dorsal spine. The posterior margin of the caudal fin is but slightly furcated, the inferior lobe is a little larger than the upper. The anal fin commences about halfway between the termination of the ventrals and the root of the caudal fin. Its height equals, its extent slightly exceeds the second dorsal. The two anterior spines are so completely covered by scales, that they escaped the observation of Russell, whose figure (CLXXX.) represents the third much too long: it exceeds but slightly  $\frac{1}{2}$  of the anterior ray. The length of the pectoral fin is  $7\frac{1}{2}$  in the total, or nearly equal that of the caudal. Above the root of the pectoral appears no trace of an elongated triangular scale, as in some other species, but in the axilla, hidden by the fin, are two elongated oval scales, much smaller than the rest. The ventral fins are a little shorter than the pectorals; the spine is strong and but slightly shorter than the anterior dorsal. At the base of each fin appears an elongated triangular scale, and a similar, but shorter and broader between the two fins; the anterior half of the fifth ray is attached to the abdomen by a membrane. A straight line between the gill-opening and the root of the caudal fin contains from 33 to 35 scales, an oblique series in front of the anterior dorsal 11 or 12. The scales are very large, nearly as broad as long; the anterior margin is straight, but with from 2 to 6 crenulations, produced by a number of radiating lines, varying in number from 3 to 7. The posterior margin is rounded and with excessively minute points, the termination of a very fine concentric net-work on the exposed

surface. Each scale is marked by a fine central line, horizontal in most, but pointing obliquely downwards on the scales immediately beneath the root of the pectoral fins.

The stomach is composed of two portions: the cardiac into which the short capacious œsophagus opens, terminates in an elongated cylindrical fundus; the pyloric portion is shorter, globular like a large button, and very thick, gizzard-like. The cavity is very small and presents a few coarse longitudinal folds. In several examined, it contained some mud, mixed with green mucus. Pylorus is surrounded by five short but capacious cœcopyloric appendages. The intestinal canal, about 7 times the length of the fish, is folded several times upon itself and firmly enveloped in fat. The gall is rather large, ovoid with a short duct opening close to Pylorus. The liver is moderate, resting across the stomach, with several lobes, of which the longest is attached to Duodenum. The spleen is small, elongated, completely hidden by the fat between the folds of the intestines. The abdominal surface of Peritoneum is black, the opposite silvery. The air-vessel is large, elongated, its parietes very thin, pearl-coloured. At Pinang this species occurs, though not numerously, at all seasons, and when newly taken it is highly valued for its excellent flavour.

The present is the fish supposed by Russell to be *Mugil cephalus*, Linné, (Vol. II. p. 64.) The figure, (CLXXX. *Bontak*,) among other inaccuracies represents the mouth without teeth, and the anal fin with a single, too long spine. The latter, as well as the margins of the scales being entire, (as they in reality appear to the naked eye,) induced Buchanan Hamilton to consider the individuals which he obtained from the estuaries of the Ganges, to be a distinct species, and also he overlooked the minute teeth in the lips. M. M. Cuvier and Valenciennes (T. XI.) unite both under the denomination of *M. cephalotus*. They doubt, however, without reason, the correctness of Russell's omitting to figure, and Buchanan to mention, any elongated triangular scale above the pectoral fins, and they believe that the fish is identical with *Mugil oür*, Forskål, (*Consp.* p. XIV. No. 109, *Var.* and characterised: "Labio utroque ciliato, inferiori unicarinato, oculis pinguedine fere obtectis, operculo macula p. p. oblonga obliqua.") Dr. Rüppell, (*Neue Wirbelth. &c. Fische*, p. 131,) observes that if Russell's description of "*Bontak*," as being "without teeth" is correct, the

fish cannot be identical with *M. oar*, the microscopical teeth of which Forskål expresses by the word "ciliato." It is to be regretted that Dr. Rüppell did not communicate a more detailed description of the fish from the Red Sea, which is most likely Forskål's species, for although Russell happens to be incorrect, the fish he described presents neither the six pores under the lower jaw, nor the arched series of pores in the adipose membrane, covering the lower part of the eye, which Dr. Rüppell points out as characters distinguishing *M. oar*. It is therefore impossible with certainty to determine if the latter is identical with the present species.

**MUGIL CUNNESIUS, Cuv. and Val.**

Russell CLXXXI. Kunnesee.

Mugil kunnesee, Cuvier R. A. II. 232 (1).

Mugil cunnesius, Cuv. and Val. XI. 114.

Mugil cunnesius, Rüppell: Neue Wirbelth. Fische, 131.

*Young.* Head above and back silvery bluish green, lighter, minutely dotted with black on the upper half of the sides; lower half and abdomen silvery white; sides and abdomen with parallel silvery lines, produced by a short line on each scale; cheeks and opercles shining silvery, the latter with steel-blue reflections; fin-membranes white, those of the dorsals and caudal minutely dotted with black, particularly towards their margins, so as to make them appear blackish; in some a black spot at the root of the upper pectoral ray, continued in the axilla as a blackish line. Iris silvery round the pupil, the rest dotted with black.

D 4—1/8, C 14½, A 3/9, V 1/5, P 16 or 17, Br. VI.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Singapore.*

Moluccas, Bay of Bengal, Coromandel, Malabar, Red Sea.

**TOTAL LENGTH:** 6½ inch.

The length of the head is ¼ of the body, not including the caudal fin. The height at the occiput is about ¾ of the length of the head. The eye occupies the second fourth of the head; the diameter, not including the adipose covering, is ¼ of the head; but the diameter of the orbit is ½ of the head; the distance across the forehead is 1½ diameter. The infraorbital is triangular, with the apex truncated, slightly rounded and finely toothed; the anterior margin is nearly straight, neither toothed nor notched. The anterior opening of the nostril is



minute, circular; the posterior a little larger, transversely oval, both situated along the upper margin of the infraorbital. The mouth is small, the lower jaw but little shorter than the upper; the angle is situated opposite the anterior opening of the nostril. The notch of the upper lip corresponds to the tubercle of the lower, which is notched underneath. There are no teeth perceptible in the lips. On each side of the vomer appears a transversal tubercle. In the young the opercles appear to be scaleless. The vertical diameter in front of the first dorsal spine equals the length of the head. A straight line from the gill-opening to the root of the caudal fin contains 42 or 43 scales; an oblique in front of the anterior dorsal fin 13.

Each scale is marked by a central line, horizontal in most, but almost vertical in those immediately below and in front of the pectoral fins. The third dorsal spine is situated at equal distance from the muzzle and the root of the caudal fin. The length of this, as well as of the two preceding spines, exceeds  $\frac{1}{2}$  of the vertical diameter of the body beneath them, and it also slightly exceeds the extent of the base of the fin itself. The fourth spine is about  $\frac{1}{2}$  of the preceding three. On each side of the base is an elongated scale. The second dorsal fin commences at equal distance from the first dorsal spine and the root of the caudal, opposite the third anal ray; the base nearly equals the length of the first ray. The caudal fin is slightly lunated: the length of the first and fourteenth ray is about  $\frac{1}{2}$  of the total length. The length of the pectoral fins is  $5\frac{1}{2}$  times in the total; above the root of each appears an elongated scale, formed like a knife-blade with the back towards the upper margin of the fin; its length is nearly  $\frac{1}{2}$  of that of the fin. At Pinang young individuals are numerous at all seasons.

MUGIL BORBONICUS, Cuv. and Val.

Mugil borbonicus, Cuv. and Val. XI. 113.

*Young.* Head above and back bluish green; lighter silvery on the upper half of the sides; lower half abdomen and cheeks silvery white; opercles shining silvery; anterior dorsal fin-membrane transparent minutely dotted with black; first spine blackish; posterior dorsal, caudal, anal and pectoral pale yellow, minutely dotted with black; spine and upper half of the first ray of second dorsal, and the upper, lower, and posterior broad margin of caudal black; at the root of the upper pectoral ray a black spot continued over the anterior half of the

inside of the pectoral ; ventrals white. Iris silvery round the pupil, blackish green towards the orbit.

D 4— $1/8$ , C  $14\frac{1}{2}$ , A  $3/9$ , V  $1/5$ , P 17, Br. VI.

HABIT.—*Pinang River.*

Bourbon.

TOTAL LENGTH : 6 inch.

The length of the head is  $\frac{1}{2}$  of the body, the caudal fin not included ; the height at occiput  $\frac{2}{3}$  of the length. The eye occupies the second fourth of the head ; the diameter of the orbit is  $\frac{1}{2}$  of the length of the head ; the distance between the eyes across the forehead is  $1\frac{1}{2}$  diameter. The infraorbital is triangular, covered with small scales, and with three pores placed obliquely in the middle of the external surface ; the anterior margin is finely toothed, and slightly arched, but becomes a little concave towards the truncated, finely-toothed apex. The superior margin is somewhat angular in the centre, on each side of which appear the openings of the nostrils. The mouth is small, transversal ; the angle is situated opposite the posterior opening of the nostril ; the lower jaw is but slightly shorter than the upper. There are no visible teeth in the lips ; the lower has in the centre a strong tubercle which in front and beneath is deeply furrowed. On each side of the vomer appears a strong transversal ridge. Under each branch of the lower jaw appear three pores. The preopercle is covered with large very thin scales, and has a long transversal incision in the posterior margin, near the angle ; the opercle and subopercle are apparently without scales, and brilliantly shining with silver. Nearly all the scales of the occiput are divided lengthwise by a shallow furrow, which on the scales of the body becomes a short longitudinal line. But the scales immediately below the pectoral fin are each marked near the root by a short vertical line. A longitudinal series between the gill-opening and the root of the caudal consists of 39 scales ; an oblique in front of the anterior dorsal fin of 14. The vertical diameter in the latter place is  $4\frac{1}{2}$  of the total length. The length of the three anterior dorsal spines is about  $\frac{1}{2}$  of the length of the head, and equals the extent of the fin itself ; the fourth spine slightly exceeds  $\frac{1}{2}$  of the length of the preceding three. At the base appears an elongated scale, extending to the posterior margin of the fin. The second dorsal spine is situated in the centre between the muzzle and the root of the caudal fin. The pos-

terior dorsal fin is situated at equal distance from the anterior and from the root of the caudal, and it commences opposite the anterior anal ray. The upper margin is falcated; the eighth ray is a little longer than the preceding. The extent of the fin equals that of the anterior dorsal. The posterior margin of the caudal is lunated. The anal fin is nearly triangular, but that the posterior ray slightly exceeds the preceding; the third spine is  $\frac{1}{2}$  the length of the anterior ray. The length of the pointed, slightly falcated, pectoral fin is  $\frac{1}{2}$  less than the length of the head; above the superior margin appears an elongated, knife-blade-like scale,  $\frac{1}{2}$  the length of the fin. The ventral fins commence opposite the posterior half of the pectorals; their length equals  $\frac{1}{2}$  of that of the head. The elongated scale above the root extends to the margin of the membrane which connects the anterior half of the fifth ray to the abdomen. The elongated scale between the fins is broader and projects far behind the latter connecting membrane.

A single young individual was obtained from a part of the Pinang River, (Sungei Pinang,) where the water is fresh.

#### SUB FAM. ATHERINOINÆ.

GEN. ATHERINA, (*Artedi*,) *Linné*, 1766.

Body elongated; two widely separated dorsals; ventrals behind the pectorals; upper jaw protractile; minute teeth in both jaws; in some species also on the vomer, palatals and pterygoids; each side with a broad silvery band. Branchiostegous rays six.

ATHERINA FORSKÅLI, Rüppell.

*Atherina hepsetus*, Forskål, 69, No. 101?

*Atherina forskålii*, Rüppell: *Neue Wirbelth*, Fische: 132,

Tab. 33, Fig. 1.

Head above, back and upper third of the sides pale sea green, dotted with black; from the axilla to the caudal a light blue longitudinal line, under which a pale yellowish, bordered beneath by a broad shining silvery band; muzzle and lips blackish; cheeks and opercles shining silvery, upper half of the latter steel-blue; throat and abdomen silvery white; fins hyaline, margins of spines and rays of the dorsals, caudal and pectorals minutely dotted with black; posterior margin of caudal blackish. Iris silvery; above the pupil a transverse bluish black spot.

D 5—1/9 or 10, C 17½, A 1/13, V 1/5, P 15, Br. VI.

HABIT.—*Sea of Pinang.*

Red Sea.

TOTAL LENGTH:  $3\frac{5}{8}$  inch.

The length of the head is  $3\frac{1}{4}$  in the total, measured to the centre of the posterior margin of the caudal. On each side of the flattened vertex, where the opercle joins, appears a longitudinal furrow containing two or three pores. Three or four such appear on the infraorbitals, several beneath the nostrils, and three beneath each branch of the lower jaw. The diameter of the eye is  $2\frac{1}{4}$  in the length of the head. At the lower part of the ascending margin of the preopercle, near the angle, is a deep incision. In both jaws, on the vomer, palatals and pterygoids appear bands of velvety teeth. The vertical diameter at the ventrals is  $5\frac{1}{3}$  in the total length. The anterior dorsal fin commences a little behind the centre of the back; the four first rays are placed close together; the fifth is somewhat removed from the fourth. The body is covered with seven longitudinal series of rather large scales; the third series from above carries the lateral line, which consists of a minute notch on the posterior margin of each scale. The anterior 7 or 8 scales of the series appear to have no such notch, so that the lateral line appears to commence on the ninth scale. The pectorals are triangular, a little downwards pointed; their length slightly exceeds  $\frac{1}{2}$  of the total length. The last ray of the second dorsal, and of the anal fin is a little elongated. Two individuals observed at Pinang in July 1843 and April 1845, differ from Dr. Rüppell's description in having five instead of six spines in the anterior dorsal fin. The smaller,  $2\frac{1}{4}$  inches in length, is of a more elongated form, its vertical diameter at the ventrals being  $\frac{1}{8}$  of the total length. It is also distinguished by having on the vertex a small raised triangular space, resembling an escutcheon, with the point between the orbits. The latter ('ecusson'), is described by M. M. Cuvier and Valenciennes as a character distinguishing *Atherina lacunosa*, Forster. As both individuals examined at Pinang present similar pores, and the characteristic incision of the margin of the preopercle, neither of which characters are noted in the description of *A. lacunosa*, their identity with *A. forskåli* cannot be doubted.

## FAM. SCOMBROIDÆ.

GEN. SCOMBER (*Artemis*) *Linne*, 1748.

Anterior dorsal fin separated by a considerable interval from the second, the posterior part of which as well as of the anal fin, forms five spurious fins; on each side of the tail two small crests, the one above the other; body fusiform with small smooth scales. Branchiostegous rays 7.

SCOMBER MICROLEPIDOTUS, Rüppell.

*Scomber microlepidotus*, Rüppell: *Neue Wirbelth. Fische*, p. 38, Taf. 11, Fig. 2.

Head above, back and sides as far as the lateral line intense steel-blue, after death with three irregular series of black spots; sides of the occiput and of the body immediately beneath the lateral line silvery light blue; lower part of the sides, abdomen, and sides of the head shining silvery, immediately behind the angle of the mouth a black triangular spot; membrane of anterior dorsal transparent, scantily dotted with brown along the spines; second dorsal, caudal, anal and the spurious fins pale yellow; the dorsal spurious fins and the caudal with black margins; ventrals and pectorals whitish, the latter with a blackish line along the root. Iris silvery round the pupil, the rest bluish black.

D 9—12—V, C  $17\frac{1}{2}$ , A  $1/11$ —V, V  $1/5$ , P 18, Br. VII.

HABIT.—*Sea of Pinang*.

Massana, (Red Sea.)

TOTAL LENGTH: 5 inch.

The length of the head is  $3\frac{1}{2}$  in the total. The diameter of the orbit is  $3\frac{1}{2}$  in the length of the head; the distance between the eyes across the forehead is  $\frac{2}{3}$  of the diameter. The anterior and posterior thirds of the eye are covered by an adipose crescent-shaped membrane, leaving a central, lanceolate space open. A single series of minute, yet visible teeth, appear in both jaws. The cavity of the mouth is whitish, minutely dotted with black; the anterior part of the tongue is flattened, rounded, and closely dotted with black, the posterior part is a narrow linear crest, covered by a series of small rounded spots of velvety teeth. The sides of the head are scaleless, except the cheeks, or the anterior half of the preopercle, which as well as the space below

the pectoral fins are covered with scales, larger than the very small ones of the body. Along the lower margin of the preopercle, appear some rather indistinct radiating lines. The vertical diameter in front of the anterior dorsal is  $4\frac{1}{2}$  in the total length. The first spine of the anterior dorsal fin is but little shorter than the second, (in the figure of Russell No. CXXXVI, *Scomber kanagurta*, Cuv. its length is  $\frac{1}{2}$  of the second,) the second and third are each  $2\frac{1}{2}$  in the length of the head. Although the present fish differs from Dr. Rüppell's in having 9 instead of 10 spines in the anterior dorsal fin, in other characters both agree so perfectly that they appear to be identical. A single individual was observed in August 1844, at Pinang.

GEN. THYNNUS (*Willoughby*, 1686), *Cuvier*, 1817.

Round the thorax a kind of corslet formed by scales larger, but less smooth than those of the rest of the body; a cartilaginous keel on each side of the tail between two small crests; anterior dorsal fin elongated, separated by a very short interval from the second.

THYNNUS AFFINIS, Cantor.

Head above and back indigo-blue, lighter, silvery, with rose-coloured reflections on the sides above the lateral line; from the angle between the points of the corslet to the tail, a number of oblique, backwards and upwards directed undulating blackish bands; sides beneath the lateral line and abdomen pale silvery or satin, with rose-coloured and light-blue reflections; cheeks and opercles shining silvery with similar reflections; anterior dorsal fin greyish buff with a dark brown line along the anterior margin of the six first spines, changing to a triangular spot in front of the succeeding ones; second dorsal, anal and their spurious fins pale brownish yellow, edged and washed with blackish; caudal yellowish buff, washed with brownish in the centre; ventrals brownish grey; pectorals silvery grey, blackish towards the margin. Iris silvery, blackish blue towards the orbit.

D 15—3/10—VIII, C 17½, A 3/11—VII, V 1½, P 27, Br. VII.

HABIT.—*Sea of Pinang*.

TOTAL LENGTH: 1 foot 10 inch.

In general outline this species resembles *T. pelamys* (Linne). But compared with the description and figure of the latter species, (Cuv. and Val. T. VIII. p. 113, Pl. 214,) the present differs in colour, number of fin rays and in characters to be pointed out. The length of

the head is contained three times in the distance from the symphysis of the lower jaw to the centre of a vertical line drawn between the fifth dorsal and the anal spurious fins; it is about  $3\frac{1}{2}$  in the total length. (In *T. pelamys* the head but slightly exceeds  $\frac{1}{3}$  of the latter.) The height at occiput is  $\frac{2}{3}$  of the length of the head.

The vertical diameter of the eye is  $\frac{1}{2}$ , the horizontal  $\frac{1}{3}$  of the distance from the point of the upper jaw to the gill-opening. (In *pelamys* the diameter of the eye is  $5\frac{1}{2}$  in the distance given.) In the upper jaw appear 23 distant, small, inwards arched teeth; in the lower 30, the posterior of which are a little stronger than the rest. The posterior part of the external margin of the palatal bones carries a single series of very minute teeth. The tongue is free, flattened, oval, and as well as the whole cavity, of a pale blackish blue colour. The vertical diameter in front of the pectoral fins is  $4\frac{1}{2}$  in the total length. The anterior dorsal spine is placed opposite the second seventh of the pectoral fin. Its length is  $\frac{1}{2}$  of the head, taken from the symphysis of the lower jaw. (In *pelamys* it is shorter.) The second spine is nearly as long, but only half the breadth of the preceding; the rest gradually decrease in length to the sixth, which is about  $\frac{1}{2}$  longer than the seventh; the succeeding decrease less perceptibly towards the fifteenth, the length of which is about  $\frac{1}{2}$  of the seventh. The distance between the anterior and second dorsal fin equals the length of the seventh spine. The anterior spine of the second dorsal fin is very short; the third scarcely exceeds  $\frac{1}{2}$  of the first ray: all three spines are so completely hid by the integuments, as to be nearly imperceptible unless the latter be removed, and such is also the case with the spines of the anal fin. A vertical line drawn between the points of the caudal fin is contained a little more than  $3\frac{1}{2}$  (in *pelamys* scarcely more than 3) times in the total length. The length of the pectoral fin is  $6\frac{1}{2}$  in the total length. The ventrals are  $\frac{2}{3}$  of the length of the pectorals, and each is received into a furrow, externally bounded by a fold of the coralet. Between the fins appears an elongated lamina, in length equalling the fifth ray, the anterior half of which is connected by a membrane to the abdomen. The corslet consists of three points: the superior extends to and clasps the second dorsal fin. The series of scales nearest the anterior dorsal fin, particularly those of the anterior part, are very large, nearly rhombic; the next three series are smaller,

yet conspicuously larger than the rest. The central point, the largest, commences opposite the seventh dorsal spine, and terminates in a blunt point opposite the fourteenth spine, while the lower, somewhat undulating margin, extends to a little in front of the origin of the ventral fins. Between the occiput and the anterior third of the pectoral fin, appears an oblique triangular space, covered with narrow elongated scales, but bounded behind by 4 or 5 oblique series of large rectangular scales. The lateral line commences gently ascending towards the sixth dorsal spine, from whence it gently descends till opposite the anterior dorsal spurious fin, when it proceeds straight to the cartilaginous keel of the tail. The third point of the coralet terminates on the abdomen, opposite the point of the pectoral fins. A single individual occurred at Pinang in December 1844.

GEN. CYBIUM, Cuvier, 1829.

Body elongated, without corset; maxillary teeth large, compressed, trenchant, (lancet-shaped;); palatal bones, anterior part of vomer, tongue and branchial arches with velvety teeth.

CYBIUM COMMERSONI, (Lacépède.)

*Scomber commerson*, Lacép. II. 600, Tab. 20, Fig. 1.

*Scomber maculosus*, Shaw: Nat. Misc. No. 982.

Russell, CXXXV. Konam.

*Scomber commersonii*, Shaw: Gen. Zool. IV., 589, Pl. 85.

*Scomber maculosus*, *Ibid.* p. 592.

*Cybiium commersonii*, (Cuv.) Rüppell: Atlas, Fische, Pg. 94, Taf. 25, Fig. 1.

*Cybiium commersonii*, Cuv. R. A. II. 200.

*Cybiium commersonii*, Cuv. and Val. VIII. 165.

*Cybiium commersonii*, Rüppell: Neue Wirbelth, Fische, p. 41.

*Cybiium commersonii*? Richardson: Report, 1845, 268.

Ikan Tanggiri of the Malays.

Head above and back intense blue with golden green reflections, lighter on the sides of the head and body to a little beneath the lateral line; the rest of the sides, the abdomen, opercles and cheeks shining silvery with lilac reflections; membrane of anterior dorsal fin pale lilac grey, minutely dotted with brown, upper margin black; second dorsal, anal and their spurious fins pale silvery lilac grey; anal and its spurious fins with white margins; caudal silvery blackish; ventrals



white; anterior half of pectorals white, posterior blackish; between the gill-opening and the root of the upper margin of the pectorals a large black spot. Iris silvery, bluish black near the orbit. After death the sides above the lateral line acquire a number of close, vertical undulating lines and spots; beneath the lateral line appear fewer and more distant black lines.

D 17—4\*/13—X, C 17 $\frac{1}{4}$ , A 4/13—X, V 1/5, P 23, Br. VII.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Singapore.*

Isle of France, Coromandel, Bay of Bengal, Massana, (Red Sea,) China Seas.

**TOTAL LENGTH:** 3 ft.

The length of the head is 4 $\frac{3}{8}$  in the total. The orbit is surrounded by a circular, rather broad, adipose membrane. The diameter of the orbit is a little less than  $\frac{1}{4}$  of the length of the head; the distance of the eyes across the forehead is a little less than two diameters. In the upper jaw appear on each side 20 to 25 large lancet-shaped teeth in the lower 10 to 15, of which the posterior ones are the largest of all; velvety teeth appear on the anterior part of vomer, on the palatals, pterygoids, on the tongue, and on the margin as well as the internal surface of each hyoid bone. The only perceptible, small elongated scales appear along the anterior dorsal, on the second dorsal, caudal and anal fins, and from behind the infraorbitals round the eye to the occiput. The vertical diameter in front of the anterior dorsal is  $\frac{1}{4}$  of the total length. The lateral line deviates but little from the upper third of the body, till opposite the first spurious dorsal fin, when it suddenly descends, describing an arch which terminates nearly opposite the fourth spurious dorsal fin; from thence it proceeds in the middle of the body, over the strong keel in front of the caudal fin. Both in

\* The anterior dorsal and the anal finrays are preceded by four spines (undivided rays) which however cannot distinctly be perceived without removing the covering scales and integuments. The caudal fin consists of 17 central branched rays, above and below which appear 14 gradually decreasing, undivided rays. The following number of finrays have been given by the different describers: Russell, whose figure is more correct than his description: D 16—16, C 24, A 14, V 6, P 22, Br. VII.

Rüppell: D 16—14—X, C 26, A 3/14—X, V 1/5, P 24, Br. VI.

Cuvier and Valenciennes: D 16—1/15—X, A 1/15—IX, P 22 or 23, Br. VII.

front of and behind the arch, the lateral line makes a few, in different individuals varying, slight undulations. The spines of the anterior dorsal fin terminate in excessively slender points, which when uninjured are completely connected by the membrane. Such, indeed, was the case but in very few young individuals observed at Pinang, the instant they were taken out of the sea. The membrane, however, is easily torn and the spines are left each terminating in a filament as represented by Dr. Rüppell (Atlas: Taf. 25, fig. 1). The fish occurs at Pinang during all seasons, but not in numbers. As an article of food it is there valued both in its fresh and dried state. Single individuals may be seen in the cold season, but very rarely, in the Calcutta bazars. But they are not eaten by Europeans, as this as well as other Indian mackerels requires to be very fresh, to be fit for the table.

**CYBIUM LINEOLATUM, Cuvier.**

*Cybiium lineolatum*, Cuv. and Val. VIII. 170.

*Cybiium lineolatum*, Bélanger : Voyage, p. 366, Pl. II. Fig. 1.

*Cybiium lineolatum*, Bleeker : Verh. Bat. Gen. XXII. 4.

Tanggiri of the Malays.

Head above and back intense blue with golden green reflections, lighter on the sides of the head and body, to a little beneath the anterior half of the lateral line; the rest of the sides, the abdomen, opercles and cheeks shining silvery with pale lilac reflections; membrane of anterior dorsal fin pale lilac grey, minutely dotted with brown, upper margin black; second dorsal and spurious fins pale silvery lilac grey; caudal silvery blackish grey; anal and spurious fins silvery white; ventrals white; pectorals silvery white, minutely dotted with black on the posterior outer half and on the whole inner surface, so closely as to appear blackish. Iris silvery, bluish black towards the orbit. After death appear several series of black spots: irregular above the lateral line; beneath the latter three or four series of longitudinal short linear spots, each series appearing like an interrupted line.

D 16—4/12—IX, C 15 $\frac{1}{2}$ , A 5/14—X, V 1/5, P 21, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Malabar, Bay of Bengal, Madura, Java.

TOTAL LENGTH: 2 feet.

The length of the head is 4 $\frac{1}{2}$  in the total measured to the centre of

the posterior caudal margin, but  $\frac{1}{4}$  to the centre of a vertical line between the points of the caudal lobes. The diameter of the orbit is  $4\frac{1}{2}$  in the length of the head; the margin of the orbit supports a rather broad circular adipose membrane. The distance of the eyes across the forehead is  $1\frac{1}{2}$  diameter. On each side of both jaws appear upwards of 18 lancet-shaped large teeth, of which, however, more than 10 or 11 are seldom present. The middle ones of the lower jaw are the largest. On the anterior part of the vomer appears a pointed triangular spot with velvety teeth, and on each palatal and pterygoid a rather broad continued line of similar teeth. Others appear at the root of the small oval, flattened tongue, on the margin and internal surface of each hyoid bone. The scales are perceptible in the places noted under *Cybbium commersoni*. The greatest vertical diameter slightly exceeds  $\frac{1}{4}$  of the total length. The lateral line, a series of short rectangular elevations, commences following the upper fourth of the body, from which it gently deviates towards the termination of the second dorsal fin; from thence it continues declining to below the middle of the body, opposite the fifth spurious fin, when it slightly ascends towards the strong keel in front of the caudal fin. The spines of the anterior dorsal fin are very slender, and the membrane is easily detached, so as to leave the filamentous points of the anterior and the whole of the posterior five or six very short spines unconnected. The anterior spine, scarcely equalling the diameter of the eye, is  $\frac{2}{3}$  of the length of the second, which is shorter than the third. The fourth, the longest, is  $\frac{1}{4}$  of the length of the head; the rest gradually decrease; the sixteenth is so short and slender that it easily may escape observation. The anterior spurious fin is often by a short membrane connected to the second dorsal and anal. Each caudal lobe equals the length of the head. The length of the pectorals is  $8\frac{1}{2}$  in the total; the ventrals  $\frac{1}{4}$  of the pectorals.

At Pinang this species occurs at all seasons, but not in numbers. In quality it resembles *C. commersoni*, and like it, a solitary, stray one, may during the cold season, be seen in the fish bazars of Calcutta.

CYBBUM GUTTATUM. (Bloch-Schneider).

*Scomber guttatus*, Bl.-Schn. 23, Pl. 5.

Russell, CXXXIV. Wingeram.

*Scomber leopardus*, Shaw: Gen. Zool. IV. 591.

*Cybinum guttatum*, Cuv. R. A. II. 200 (!).

*Cybinum guttatum*, Cuv. and Val. VIII. 173.

*Cybinum kuhlii*, Cuv. and Val. *ibid.* 178 (*Young*).

*Cybinum guttatum* Richardson, Report, 1845, 268.

*Cybinum guttatum*, Bleeker: Verh. Bat. Gen. XXII. 4.

Tanggiri papan of the Malays.

*Adult.* Membrane of the first seven or nine spines of anterior dorsal fin black, that of the succeeding spines white, minutely dotted with brown, and broadly edged with black; rest of the body and eyes coloured like *Cybinum lineolatum*. After death appear on the back and upper half of the sides numerous black rounded and oval spots, of different sizes, mostly irregularly scattered, here and there in regular longitudinal series.

D 18—4/16—X, C 15½, A 5/16—IX, V 1/5, P 21, Br. VII. or D 17—5/16—X, A 6/16—IX.

*Young.* Ventrals, second dorsal, anal and their spurious fins pale yellowish; caudal whitish, the root the posterior margin and between the central five rays silvery bluish. Rest of the body like the adult, but no black spots appear after death.

D 17—5/17—VII, A 6/16—VII, or D 15—5/16—VIII, A 6/16—VIII.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Singapore.*

Java, Madura, Malabar, Coromandel.

**TOTAL LENGTH:** 3 feet.

The length of the head is  $\frac{1}{2}$  of the total, measured to the centre of the posterior caudal margin, but  $5\frac{1}{2}$  in the total, measured to the centre of a vertical line between the points of the caudal lobes. The orbit is surrounded by a circular adipose membrane. The diameter of the orbit is  $\frac{1}{2}$  of the length of the head. The distance of the eyes across the forehead is  $1\frac{1}{2}$  diameter. The maxillary teeth are generally shorter and less broad than in *C. commersoni* or *lineolatum*. On each side of the upper jaw appear upwards of 19, of the lower upwards of 15 teeth. The velvety teeth are disposed as in *C. lineolatum*, but they are more numerous, as the whole of the roof of the mouth, bounded in front by the vomer and on each side by the palatals, is studded with patches of teeth. The very centre of the roof behind the anterior pointed part of vomer, presents a singular appearance: it is covered with linear de-

vations separated from each other by narrower lines of the naked lining membrane. The greatest vertical diameter in front of the second dorsal fin equals the length of the head. The lateral line, consisting of little rectangular elevations, follows the outline of the back while gently declining till opposite the third or fourth dorsal spurious fin; from thence it continues straight to the strong keel in front of the caudal fin. In the young of this and the preceding species the latter keel is very little developed. Single individuals occur at Pinang at all seasons, and are valued as articles of food. In Calcutta they are very rarely seen, and during the cold season only.

GEN. *TRICHIURUS*, *Linné*, 1766.

Body elongated, compressed, with a single extensive dorsal fin; tail terminating in a slender finless filament; neither ventrals nor anal, but instead of the latter a number of minute spines; muzzle elongated; lower jaw projecting beyond the upper, both with distant lancet-shaped teeth, among which several arched ones longer than the rest, and with the posterior part of the point barbed; each palatal with a series of velvety teeth. Branchiostegous rays seven.

*TRICHIURUS HAUMELA*, (*Forskål.*)

Willoughby: App. Pl. 3. Fig. 3.

*Clupea haumela*, *Forskål*: Fauna Arab. p. 72, No. 106.

*Clupea haumela*, *Linné*: Syst. 1408.

*Laotépède*, II. Pl. 7, Fig. 1.

*Russell* XLI. Sawala.

*Trichiurus lepturus*, *Buchan.* Ham. Fishes, p. 31, 364.

*Trichiurus haumela*, *Cuvier*, R. A. II. 218.

*Trichiurus haumela*, *Cuv. and Val.* VIII. 249.

*Trichiurus haumela*, *Rüppell*, N. W. Fische, 41.

*Trichiurus haumela*, *Swainson*, II. 254.

*Trichiurus haumela*, *Bleeker*: Verh. Batav. Gen. XXII. 4.

*Ikan Púchuk* of the Malays.

*Adult.* Head above, back and naked point of the tail blue blackish, lighter silvery on the jaws, sides of the head and body; abdomen silvery; dorsal rays and membrane pale reddish yellow, the latter to the twelfth ray, and from thence the upper half, minutely dotted with

black, so as to appear blackish; anterior third of pectorals pale reddish yellow, the rest blackish. Iris silvery blue, blackish towards the orbit.

*Young.* Head above, back and naked point of the tail silvery bluish; the rest of the body shining silvery; dorsal and pectorals yellowish white, minutely dotted with black like the adult, without, however, acquiring the blackish general appearance of the latter.

D 127 to 133, P 11, Br. VII.

*HABIT.*—*Sea of Pinang, Malayan Peninsula, Singapore.*

Chusan, Canton River, Coromandel, Bay of Bengal, Gangetic estuaries, Malabar, Djetta, (Red Sea,) Java, Celebes, Madura.

**TOTAL LENGTH :** 2 feet 8 inch.

The length of the head, measured from the symphysis of the lower jaw to the termination of the opercle, is  $\frac{1}{4}$  of the total. The diameter of the eye is  $\frac{1}{4}$  of the length of the head, or  $\frac{1}{2}$  of the vertical diameter of head through the eye itself. In the upper jaw appear on each side upwards of 15 distant teeth, of which the anterior pair which are present in the very young ones only, are directed forwards. Behind these appear a pair, or a single lower arched tooth, the posterior part of the point of which is barbed. Next follow 3 or 4 very small lancet-shaped, behind which is a very long arched, half-barbed tooth. The rest of the space is occupied by some distant lancet-shaped teeth, of which those in the middle are the largest. On each side of the symphysis of the lower jaw appears an arched tooth, like the corresponding one of the upper jaw, but shorter. Behind the tooth is a vacant space, followed by upwards of 12 lancet-shaped teeth, which with the exception of one or two half-barbed in the middle, are smaller than the corresponding of the upper jaw. Along the margin of each palatal is a series of velvety teeth. The tongue is small, oval, a little pointed, and smooth. The anterior dorsal ray is  $\frac{1}{4}$  of the length of the head. The greatest vertical diameter of the body is generally  $\frac{1}{17}$ , but in the adult  $\frac{1}{17}$  of the total length. This species is excessively numerous at all seasons in the Straits of Malacca and in the estuaries of the Ganges. The common length is about one foot, and but a solitary individual of 2 feet 8 inch was observed at Pinang. The fish is consumed fresh, but chiefly dried, by the natives, and forms in the latter state an article of exports.

tion. It is of voracious habits, devouring its own kind, as well as other fishes, and crustacea. The adult had a nodulous enlargement of the size of a coffee seed, on one of the anal interspinal bones, similar to those observed in *Platax arthriticus*, Cuv. and Val.

*TRICHIURUS SAVALA*, Cuvier.

*Trichiurus savala*, Cuvier, R. A. II. p. 219.

*Trichiurus armatus*, Gray : Zool. Misc. 9, (*Excl. Syn.*  
*Sawala, Russell.*)

(*Icon.*) *Trichiurus armatus*, Gray : Ill. Ind. Zool. II. Pl. 93,  
Fig. 1.

*Trichiurus savala*, Cuv. and Val. VIII. p. 251, Pl. 224.

*Trichiurus savala*, Cantor : Ann. Nat. Hist. IX. 15.

*Trichiurus armatus*, Richardson, Report, 1845, 268.

Púchuk of the Malays.

Head above, back and the naked point of the tail pale bluish, all other parts shining silvery ; dorsal and pectoral rays yellowish white, their membrane hyaline. Iris silvery, bluish towards the orbit.

D 112 to 120, P 11, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Canton River, Chusan, Pondicherry, Bay of Bengal, Gangetic estuaries, Malabar, China Seas.

TOTAL LENGTH : 1 foot 4 inch.

The length of the head is from  $6\frac{1}{4}$  to  $7\frac{1}{4}$  in the total. The diameter of the eye is from  $8\frac{1}{4}$  to  $\frac{1}{2}$  of the length of the head, or  $\frac{1}{4}$  of the vertical diameter of the head through the eye itself. The anterior rays of the dorsal fin are proportionally shorter than in *T. haumela* : the length of the first ray but slightly exceeds the diameter of the eye. The lancet-shaped teeth of the jaws are proportionally smaller than in the preceding species, which it in other respects greatly resembles. Although not very scarce at Pinang and at the Sandheads, it is of far rarer occurrence than *T. haumela*, which it resembles in voracious habits. As observed by M. M. Cuvier and Valenciennes, neither species is electrical, but both give at certain seasons, like many other fishes, a vivid phosphoric light.

GEN. ELACATE, Cuvier, 1829.

Head depressed ; body fusiform ; a number of free spines preceding the dorsal fin, but none the anal ; no keel in front of the caudal fin.

**ELACATE BIVITTATA, Cuv. and Val.**

*Elacate bivittata*, Cuv. and Val. VIII. 338.

*Elacate bivittata*, Temm. Schl. Fauna Japon. Pisc. 104, Pl. LVI.

*Elacate bivittata*, Richardson, Report, 1845, 269.

Head above and back inky, or bluish black; from the posterior part of the orbit to the root of caudal, a pale silvery longitudinal band, dotted with black; from the shoulder, enclosing the posterior  $\frac{1}{2}$  of the lateral line, an intense bluish black band; beneath which a narrower, pale silvery, dotted with black; under which a bluish black; throat and abdomen pale silvery, dotted with black; upper half of sides of the head silvery blackish; lower half: pale silvery dotted with black; dorsal free spines, and all fin rays whitish; their membranes pale greyish, minutely dotted with brown so as to acquire a general brownish, or bluish black appearance; caudal whitish at the root, and with a white triangular spot at the upper and lower angle; in some the posterior margin whitish; pectorals whitish at the root, the rest intense black. Iris silvery, minutely dotted with black.

D 8—2/30, 34, 35 or 36, C  $17\frac{1}{2}$ , A 2/25, 26, 27 or 28, V 1/5,  
P 20, Br. VII.

**HABIT.**—*Sea of Pinang, Singapore.*

Moluccas, Japan, China Seas.

**TOTAL LENGTH:** 2 feet.

The length of the head is  $\frac{1}{2}$  of the total. The eye is surrounded by a large circular adipose membrane. The transversal diameter of the orbit is  $\frac{1}{2}$ , the vertical  $\frac{1}{2}$  of the length of the head. The distance of the orbits across the forehead slightly exceeds their transversal diameter. The diameter of the eye itself is  $\frac{1}{2}$  of the length of the head. Besides the cardlike teeth of both jaws, the vomer and the palatals, the whole of the roof of the mouth between the three latter bones, the tongue and the innerside of the gums are covered with velvety teeth. As in *E. pondiceriana*, Cuv. and Val. the upper surface of the cranium has on each side a fascicle of striæ, radiating forwards and backwards. They are indeed less apparent during life and in specimens preserved in spirits, than in dried ones, which probably accounts for M. M. Cuvier and Valenciennes describing the surface as nearly smooth (VIII. p. 338.) On each opercle appear upwards of 9 backwards radiating, sharp striæ. Each side of the occiput and the cheeks are covered with small oval



slightly pointed scales, like those of the body ; the rest of the head is naked. The eight free dorsal spines are all directed backwards ; each is attached to its groove by a small triangular membrane. The anterior ray of the dorsal and anal fins is shorter than the second, and not branched like all the succeeding. The lateral line proceeds nearly straight towards the termination of the pectorals from whence it gently declines, keeping the middle of the body, and terminating a little in front of the posterior margin of the caudal. It makes several slight undulations, and the anterior portion is sometimes found double, the one above the other. The length of the caudal fin is  $\frac{1}{3}$  of the total ; the posterior margin is straight, vertical. The pectoral is a little falcated ; the length  $\frac{1}{2}$  of the total, nearly double the length of the ventrals. The stomach is an elongated muscular sac ; at some distance from the pylorus appears a cœcum, nearly as long as the stomach, from the side of which proceed a number of short processes, each terminating in many minute branches, all forming a countless mass of cœca. The intestinal canal makes a single circumvolution : its length is about  $\frac{1}{3}$  of the total. The liver is elongated, single-lobed. The gall-bladder is reduced to a narrow tube. The spleen is small triangular. There is no air-vessel. In several dissected the stomach contained fishes (*Clupeoidæ*) and *Loligo*. Single individuals occur at all seasons at Pinang. They are eaten by the natives.

GEN. CHORINEMUS, Cuv. and Val. 1831.\*

Body oblong, compressed ; no keel in front of the caudal fin ; anterior dorsal fin consisting of singly moveable spines, each with a small membrane ; the first of these spines preceded by an immoveable one,† more or less hid in the skin and pointing forwards ; rays of the second dorsal and anal fin either entirely detached, or united by a membrane so brittle, as to easily disappear, and make the rays resemble spurious fins ; two free spines, resembling those of the anterior dorsal, behind the anus.

\* Substituted for *Scomberoides*, Lacépède, 1800.

† As the immoveable spine is rarely perceptible except in very young individuals, it will not be given in the formulas of the dorsal fins, but special mention will be made of it.

## CHORINEMUS LYSAN, (Forskål.)

*Scomber lysan*, Forskål : Pl. 54, No. 67.

*Scomberoide commersonien*, Lacép. II. Tab. 20, fig. 3.

Russell, CXLI. Aken Parah.

*Scomber madagascariensis*, Shaw, Gen. Zool. IV. Pt. II. p. 590,  
Pl. 85.

*Lichia lysan*, Rüppell : Atlas, p. 91.

*Scomberoide commersonien*, Cuv. R. A. II. 204 (?).

*Scomber lysan*, Cuv. *Ibid.*

*Scomber madagascariensis*, Bennett : Life of Raffles.

*Chorinemus commersonianus*, Cuv. and Val. VIII. 370.

*Chorinemus lyzan*, Cuv. and Val. VIII. 387.

*Chorinemus lysan*, Rüppell, N. W. Fische, 44.

*Chorinemus commersonii*, Bleeker : Verh. Batav. Gen. XXII. 4.

Tallang raya of the Malays.

Head above and back golden greenish olive, the rest of the head and body brilliant golden citrine or sulphur colour; second dorsal, anal, pectoral and caudal like the body, but not golden; posterior margin of caudal blackish, anterior dorsal, ventrals and post-anal spines white. Iris golden sulphur-coloured, greenish towards the orbit.

*After death.* Head above and back greyish olive, lighter on the sides towards the lateral line; rest of the head and body silvery; sides along or above the lateral line with 6 or 7 large oval blue-blackish or greyish spots; second dorsal, anal, pectoral and caudal yellowish white. Iris silvery.

D 7 or 6—1/20, C 17½, A 2—1/18, V 1/5, P 18, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Sumatra, Java, Madura, Coromandel, Red Sea, Madagascar.

TOTAL LENGTH : 2 feet.

The length of the head is  $4\frac{1}{2}$  in the total, measured to the centre of the posterior margin of the caudal; the height at occiput nearly equals the length of the head. The diameter of the orbit, supporting an adipose membrane, is  $\frac{1}{4}$  of the length of the head; the distance across the forehead equals the diameter. The angle of the mouth is situated at some distance behind the orbit; the distance from the muzzle to the angle of the mouth slightly exceeds  $\frac{1}{2}$  the length of the head. The immoveable spine preceding the first dorsal, is apparent in the

very young, but later it becomes entirely hid by the integuments. The lateral line forms an obtuse angle opposite the first dorsal spine, and at equal distance between the latter and the middle of the pectoral fin. The anterior of the black spots which appear after death is situated beneath the origin of the lateral line, between it and the root of the pectoral; the upper part of the opercle becomes frequently blackish; of the rest of the spots, the two or three are above, but touch the lateral line; the others are altogether above it. The scales are minute, oval, with a longitudinal central furrow, and enveloped in the transparent epidermis. The greatest vertical diameter of the body, in front of the posterior dorsal fin varies from  $3\frac{1}{2}$  to  $3\frac{1}{2}$  in the total length.

At Pinang single individuals occur at all seasons. They are eaten either fresh or dried by the natives.

*CHORINEMUS* TOL, Cuvier and Valenciennes.

Russell, CXXXVIII. Tol Parah.

*Chorinemus tol*, Cuv. and Val. VIII. p. 385.

Head above and back metallic bluish grey, lighter on the sides to a little above the lateral line; opercles and the rest of the body silvery white; pectorals and caudal yellowish white, the latter edged with blackish; the rest of the fins white; the angle of the second dorsal fin black. Iris silvery, bluish black towards the orbit.

*After death.* Upper part of opercle and a spot immediately behind it, metallic bluish grey; in some a series of from 6 to 8 similar spots above the lateral line.

D 7— $1/20$  or 21, C  $17\frac{1}{2}$ , A 2— $1/18$ , 19 or 20, V  $1/5$ , P 18, Br. VII.

*HABIT.*—*Sea of Pinang, Malayan Peninsula, Singapore.*

Amboyna, Buru, Coromandel, Bay of Bengal, mouths of the Ganges, Malabar.

**TOTAL LENGTH :**  $8\frac{1}{2}$  inch.

The length of the head is from  $4\frac{1}{2}$  to  $\frac{1}{2}$  of the total, measured to the centre of the posterior margin of the caudal fin; the depth at occiput is  $\frac{1}{2}$  of the length of the head. The transversal diameter of the orbit is  $3\frac{1}{2}$  in the length of the head; the distance across the forehead equals the diameter. The greatest vertical diameter of the body equals the length of the head. The lateral line makes a very obtuse angle opposite the third dorsal spine, from thence it declines till opposite the third or fourth ray of the second dorsal, when it proceeds straight to

the centre of the caudal. The length of the lobes of the caudal equals that of the head, but generally one of the lobes is shorter than the other. The length of the pectorals and ventrals slightly exceeds  $\frac{1}{2}$  of the length of the head. The angle of the mouth is situated beneath the centre of the orbit; the lower jaw slightly projects beyond the upper. The scales appear like numerous, close, horizontal needles. The immoveable spine preceding the first dorsal, is in some partially apparent, in others entirely hidden. Younger individuals are at Pinang excessively numerous during all seasons, and are dried by the natives.

GEN. TRACHYNOTUS, (Lacép.) Cuvier, 1817.

(CÆSIOMORUS, Lacép. 1800.—ACANTHINION, Lacép. 1802.—)

Differs from Gen. *Lichia* by a more elevated body, a profile more rapidly descending in front of the eyes, and by the more elongated points of the second dorsal and anal fin.

TRACHYNOTUS MOOKALEE, Cuv. and Val.

*Gasterosteus ovatus*, Linné, Syst : 1325 ?

*Centronote ovale*, Lacépède ?

Russell, CLIV. Mookalee Parah.\*

*Trachinotus mookalee*, Cuv. and Val. VIII. 423.

Head above and back silvery green; sides above the lateral line golden green; beneath the line, abdomen and opercles golden gamboge; all fins gamboge; anterior margin of dorsal spines and first ray of second dorsal blackish; membrane of second dorsal, caudal and pectorals minutely dotted with brown. Iris golden gamboge, green towards the orbit.

D 6—1/19. C 17 $\frac{1}{4}$ , A 2—1/17, V 1/5, P 20, Br. VII.

HABIT.—*Sea of Pinang.*

Coromandel, Malabar.

TOTAL LENGTH : 8 inch.

The length of the head is  $\frac{1}{4}$  of the total measured to the centre of the posterior margin of the caudal; the depth at the occiput exceeds by  $\frac{1}{2}$  the length of the head. The diameter of the orbit is  $\frac{1}{4}$  of the

\* Dr. Rüppell considers this identical with *Trachinotus falcatus*, (Forsk.) of which also the following synonymes are given : *Scomber falcatus*, Forkal, p. 57. No. 76.—*Cæsiomorus blochii*, Lacép. III. Tab. 3, Fig. 2.—(Rüppell : Atlas, p. 88.) To these the author has later added : *Trachinotus drepanis*, Cuv. and Val. VIII. 429,

length of the head. The infraorbital is broad, rounded in front, tapering to a point beneath the centre of the orbit, so as to leave the inferior half of the narrow maxillary bone exposed. The preopercle consists of a very narrow vertical portion, and a shorter, broader horizontal; where both join, the posterior margin describes a segment of a circle. The external surface is divided in two parts by a ridge in the middle: the anterior part has at the angle four longer and several smaller spine-like radiating processes, between which appear numerous radiating lines which continue along the vertical part of the posterior margin, which has the appearance of being very finely denticulated in an oblique upward direction. The angle of the mouth is situated in front of the orbit. In a young individual, 3½ inches in length, a band of card-like teeth appear in both jaws; but in another, 8 inches in length, the jaws have no perceptible teeth, and such was also the case in those examined by Russell. M. M. Cuvier and Valenciennes describe their specimens of *T. mookalee* with velvety, easily perceptible teeth in both jaws.\* It would therefore appear that some, not all, individuals with age lose their teeth. As a young individual examined at Pinang has very distinct teeth, it follows that the division adopted by Dr. Rüppell (Atlas, p. 88) of *Trachinotus*, Lacép. containing species supposed to have no teeth, is inadmissible. The anterior opening of the nostrils is much smaller than the posterior.

The lateral line commences slightly ascending till above the point of the pectoral fin, from whence it gently descends till opposite the posterior third of the second dorsal, when it proceeds straight to the middle of the caudal fin. The scales of the body are very minute, appearing like points. In the young individual examined at Pinang, the spine preceding the moveable dorsal ones, had the point projecting, but in the larger one, although perceptible, it was imbedded in the integuments. In Russell's figure the point projects. The length of the point of the second dorsal slightly exceeds  $\frac{2}{3}$  of the extent of the base of the fin. The point of the anal is a little shorter. The greatest vertical diameter, in front of the second dorsal, is by  $\frac{1}{2}$  less than half of the total length. The lobe of the caudal is  $\frac{1}{2}$  of the total length. The length of the pectorals is  $\frac{2}{3}$  of the head; that of the ventrals  $\frac{1}{2}$

\* *T. blochii* (Lacép.) and *T. falcatus*, (Forsk<sup>sk</sup>l), which Dr. Rüppell considers to be identical with the present species, have no teeth. (Cuv. and Val. VIII.)

of the pectorals. The two above mentioned individuals were observed at Pinang in June, 1843, and in February, 1845.

*TRACHYNOTUS QUADRI-PUNCTATUS*, (Rüppell.)

*Cæsiomorus quadripunctatus*, Rüppell: Atlas, p. 90, Tab. 24.

Fig. 1.

*Trachinotus quadripunctatus*, Cuv. and Val. VIII. 434.

Head above and back silvery greyish green, lighter on the sides to a little above the lateral line; rest of the sides, abdomen, opercles and cheeks silvery white; on the lateral line 2 to 5 distant black spots; fins hyaline; point of second dorsal and anal, and lobes of caudal black. Irish silvery, greenish towards the orbit.

D 6—1/22, C 17½, A 2—1/22, V 1/5, P 17, Br. VII.

HABIT.—*Sea of Pinang.*

Massana, (Red Sea,) Seychelle Islands.

TOTAL LENGTH: 7½ inch.

The length of the head is 4½ in the total, measured to the centre of the posterior margin of the caudal; the depth at the occiput equals the length of the head. The diameter of the orbit is 3½ in the length of the head. The nostrils, the infraorbital and the preopercle resemble *T. mookalee*. In both jaws, on the vomer and palatals appear card-like teeth. The lateral line is slightly arched downwards till the origin of the second dorsal fin, from whence it proceeds straight in the middle of the body towards the caudal. The scales are minute, scarcely perceptible. In the individual examined at Pinang the point of the immoveable spine, preceding the first dorsal, projected far beyond the integuments. On the left lateral line appeared four small black spots: the first opposite the 4th dorsal spine, the second, the largest of all, opposite the root of the second dorsal, the third opposite the middle of, and the fourth opposite the termination of the second dorsal. On the right lateral line, however, the last spot was absent. The individual described by Dr. Rüppell had on each side two such spots, corresponding to the second and third in the present. In those examined by M. M. Cuvier and Valenciennes the number of spots varied from 3 to 5. The greatest vertical diameter of the body in front of the second dorsal is 2½ in the total length, measured to the centre of the posterior margin of the caudal. The length of the point of the second dorsal equals the extent of the base of the fin; that of the anal

slightly exceeds it. The length of the caudal lobes is  $2\frac{1}{2}$  in the total, measured as above observed. The pectorals are  $\frac{2}{3}$  of the length of the head; the ventrals  $\frac{2}{3}$  of the pectorals. A single individual was taken at Pinang in June 1845, while unusually strong southerly winds prevailed. The fishermen asserted the species to be of very rare occurrence.

GEN. APOLECTUS, Cuvier and Valenciennes, 1831.

Differs from *Trachynotus* by the ventral fins being fixed under the throat.

APOLECTUS STROMATEUS, Cuv. and Val.

*Apolectus stromateus*, Cuv. and Val. IX. 439.

Head above back and sides to the lateral line silvery brownish olive; cheeks, opercles and abdomen silvery pale neutral tint, everywhere minutely dotted with black; dorsal and anal pale greenish olive, minutely dotted with black; edges and the posterior part, containing the 3 or 4 last rays yellowish white; ventrals blackish; pectorals yellowish white, minutely dotted with black; caudal yellowish white, posterior half minutely dotted with black. Iris silvery buff, orbital half blackish blue.

D 4— $1/43$ , C  $17\frac{1}{4}$ , A 2— $1/37$ , V  $1/5$ , P 21, Br. VI.

HABIT.—*Sea of Pinang.*

Java, Pondicherry.

TOTAL LENGTH:  $3\frac{1}{2}$  inch.

The length of the head is  $3\frac{1}{2}$  in the total, measured to the centre of the posterior margin of the caudal fin; the depth at occiput exceeds by  $\frac{1}{2}$  the length. The diameter of the eye is  $\frac{1}{3}$  of the length of the head. In each jaw appears a single series of excessively fine teeth. The greatest vertical diameter in front of the second dorsal fin is  $1\frac{2}{3}$  in the total length. In front of the first minute dorsal spine appears an immoveable forward-pointing one, anterior to which two minute spines may be felt by passing the finger along that part of the back. The length of the point of the second dorsal and anal fins is  $2\frac{2}{3}$  in the total. That of the falcated pectorals and caudal lobes is  $\frac{1}{2}$  of the total length. The ventrals are  $\frac{1}{2}$  of the pectorals; the rays are very slender. A single individual was observed at Pinang in June, 1844.

GEN. CARANX, (*Lacép.* 1800,) Cuvier, 1829.

Lateral line more or less mailed with scaly plates, each keeled and

with a spine; two dorsal fins; a horizontal immoveable spine in front of the anterior dorsal; two free spines in front of the anal; body, the lateral line excepted, covered with small scales; crest of cranium treachant; last rays of second dorsal often slightly connected; in some separated in spurious fins.

*A.—With several spurious fins behind the second dorsal and anal.*

CARANX ROTTLEI, (Bloch.)

*Scomber cordyla*, Linné, Syst. 1332?

*Scomber rottleri*, Bloch, Tab. 346.

Russell, CXLIH. Woragoo.

*Scomber rottleri*, Shaw, IV. 598.

*Caranx rottleri*, (Lacép.) Rüppell: Atlas, 102.

*Caranx rotleri*, Cuv. R. A. II. 208 (')

*Caranx rotleri*, Cuv. and Val. IX. 29.

*Caranx rotleri*, Rüppell, N. W. Fische, 48, 52.

*Caranx rotleri*, Richardson, Report, 1845, 273.

Head above and back steel blue or silvery dark green, lighter on the sides towards the lateral line; the latter as well as the rest of the body shining silvery; on the upper part of opercle a bluish black spot; fins transparent, yellowish; point of the second dorsal, and margin of the caudal minutely dotted with black. Iris silvery; adipose fold of the orbit pale amber-coloured.

D 8—1/10 or 11—IX, C 17½, A 2—1/8—VIII or VII, V 1½, P 22.

Br. VII.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Singapore.*

Coromandel, Malabar, Massaua, (Red Sea,) China Seas.

**TOTAL LENGTH:** 7 inch.

The length of the head is  $\frac{1}{4}$  of the body, the caudal not included; the greatest vertical diameter, in front of the second dorsal fin, is  $3\frac{1}{4}$  in the length of the body. The diameter of the orbit is a little less than  $\frac{1}{2}$  of the length of the head; the broad adipose fold of the orbit leaves a vertically oval space, in which the eye appears. The anterior part of the lateral line is formed by very small rounded scales and describes a short high arch, which terminates opposite the middle of the anterior dorsal fin; the rest of the line is straight, consisting of 53 to 55 oblique, keeled and spinous plates. The anterior of the latter are narrow; each nearly  $\frac{1}{4}$  of the vertical diameter of the body; the posterior ones



increase in breadth and entirely cover the tail. The falcated pectoral fins are  $3\frac{1}{2}$  in the total length, measured to the centre of the posterior margin of the caudal. Single individuals occur at all seasons at Pinang. They are eaten by the natives.

*B.—Without spurious fins behind the second dorsal and anal fins.*

**CARANX VARI**, Cuv. and Val.

*Caranx vari*, Cuv. and Val. IX. 48.

Head above and back steel blue with silvery green reflections, lighter on the upper half of the sides; the rest of the body shining silvery; abdomen with rose-coloured reflections; on the upper part of the opercle and at the commencement of the lateral line a large pale bluish-black spot; anterior dorsal fin black; second dorsal and caudal pale yellowish white, their marginal halves minutely dotted with black; the rest of the fins hyaline, white; the middle of the anal sparingly dotted with brown. Iris silvery; adipose fold of the orbit pale amber-coloured.

D 8—1/24, C 17 $\frac{1}{2}$ , A 2—1/20, V 1/5, P 19, Br. VII.

**HABIT.**—*Sea of Pinang.*

Pondicherry.

**TOTAL LENGTH:** 6 $\frac{1}{2}$  inch.

The length of the head is  $3\frac{1}{2}$  in. that of the body, or  $3\frac{1}{2}$  in the total measured to the centre of the posterior margin of the caudal. The inferior margin of the opercle is very slightly concave. The diameter of the orbit is  $3\frac{1}{2}$  in the length of the head; the opening of the adipose fold of the orbit is vertically oval. The greatest vertical diameter of the body, in front of the second dorsal, is  $\frac{1}{3}$  of the length of the body. The arched portion of the lateral line extends to opposite the anterior part of the second dorsal, the straight portion consists of from 55 to 58 plates, none of which exceeds in height  $\frac{1}{4}$  of the greatest vertical diameter of the body. The falcated pectorals are  $3\frac{1}{2}$  in the total length. This species is of uncommon occurrence at Pinang.

**CARANX MATE**, Cuv. and Val.

*Caranx mate*, Cuv. and Val. IX. 54.

Head above and back steel blue, with silvery green reflections; lighter on the upper half of the sides, rest of the body shining silvery; abdomen with mother-of-pearl reflections; pectoral, caudal and second

dorsal yellowish white, the latter minutely dotted with black towards the margin; first dorsal, ventrals and anal whitish, the latter sparingly dotted with brown; upper part of opercle with a bluish black spot. Iris silvery; adipose fold of the orbit pale amber-coloured.

D 8—1/24, C 17½, A 2—1/20, V 1/5, P 22, Br. VII.

HABIT.—*Sea of Pinang.*

Seychelles, New Guinea, Anjer, Pondicherry.

TOTAL LENGTH: 9½ inch.

The length of the head slightly exceeds 3¼ in the total, measured to the centre of the posterior margin of the caudal; the depth at the occiput is ¾ of the length of the head. The diameter of the orbit is 3¾ in the latter; the opening of the adipose fold of the orbit is vertically oval. The lower margin of the opercle is nearly straight, or slightly concave about the middle. The greatest vertical diameter of the body in front of the second dorsal is 3½ in the total length. The arched portion of the lateral line terminates opposite the anterior fourth of the second dorsal; the rest is straight and covered by 37 to 40 plates, none of which in height exceeds ¼ of the greatest vertical diameter of the body. The length of the falcated pectorals is 3½ in the total. The last dorsal and anal ray is stronger and more elongated than the preceding ones, and as the connecting membrane easily becomes torn, these two rays acquire the appearance of spurious ones. M. M. Cuvier and Valenciennes describe *C. xanthurus* as corresponding in every respect to the present species, except in its having a series of eight or nine dorsal spots of a darker blue than the rest of the back.

From *C. affinis*, Rüppell, (*Neue Wirbelth. Fische*, 49, Tab. 14, Fig. 1.) the present also differs but slightly; in *affinis* the head is ¼ of the total length, and the pectorals equal the length of the head; both are therefore shorter than in the present. The first dorsal spine is ½ of the fourth, the longest. In the present the first spine is 2½ in the length of the third and fourth, which are of equal length. Single individuals occur at all seasons at Pinang. They are eaten by the natives.

CARANX LEPTOLEPIS, Kuhl. and Van Hasselt.

*Caranx leptolepis*, Cuv. and Val. IX. 63.

*Caranx mertensii*, Cuv. and Val. IX. 64.

Head above and back steel blue; from above the orbit to the caudal

a broad gamboge band; the rest of the body shining silvery; dorsal and caudal fins gamboge, the rest white. Iris silvery, blue towards the orbit. In some individuals a large bluish black spot on the upper part of the opercle.

D 8—1/25 or 26, C 17½, A 2—1/22 or 23, V 1/5, P 20, Br. VII.

HABIT.—*Sea of Pinang, Singapore.*

Java, Manilla.

TOTAL LENGTH: 4½ inch.

The length of the head is 3½ in the total, measured to the centre of the posterior margin of the caudal; the depth at occiput is ½ less than the length. The diameter of the orbit, which is surrounded by a very narrow adipose fold, is ½ of the length of the head. The lower margin of the opercle is straight. The snout is uncommonly protracile; the teeth of both jaws are excessively minute, so as to be barely perceptible to the touch. The very slight arch of the lateral line terminates opposite the middle of the second dorsal; the anterior part of the rest is covered by minute scales, which do not perceptibly increase in size till opposite the posterior third of the second dorsal, from whence may be counted 25 such. None of these scales exceed 1/16 of the greatest vertical diameter of the body, which equals the length of the head. The length of the falcated pectorals also equals that of the head. M. M. Cuvier and Valenciennes describe *C. mertensii* as merely differing by the absence of the black opercular spot. At Pinang, where the fish is uncommon, individuals occur with and without the spot, in forms and colours so exactly like, as to leave no doubt about their identity.

*C.*—*With trenchant profile, forming a segment of a circle; plates exclusively on the straight portion of the lateral line; pectorals falciform; in front of the first dorsal an immoveable horizontal spine, often hid in the integuments.*

CARANX FORSTERI, Cuv. and Val.?

Scomber hippos, Lin. apud Forster?

Caranx forsteri, Cuv. and Val. IX. 107?

*Young.* Head above and back golden green, lighter on the sides; rest of the body shining silvery; abdomen with mother-of-pearl reflections; at an angle of the opercle a very faint bluish black spot; first dorsal minutely dotted with brown, so as to appear pale grey; ventrals and

anal white; pectoral, caudal and second dorsal yellowish, the point and margin of the latter, and the posterior margin of the caudal minutely dotted with brown, so as to appear greyish. Iris silvery, bluish black towards the orbit.

D 8—1/20 or 21, C 17 $\frac{1}{2}$ , A 2—1/15, 16 or 17, V 1/5, P 19, Br. VII.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 4 $\frac{1}{2}$  inch.

The length of the head is a little less than 3 $\frac{1}{4}$  in the total, measured to the centre of the posterior margin of the caudal fin; the depth at occiput equals the length. The diameter of the orbit is 3 $\frac{1}{4}$  in the length of the head. The infraorbital is longer than broad: its greatest breadth, along the superior margin equalling  $\frac{1}{2}$  the diameter of the orbit. The arched, very slightly undulating, portion of the lateral line terminates opposite the fifth or sixth ray of the second dorsal; the straight portion is covered by 30 to 31 plates, none of which exceed about  $\frac{1}{4}$  of the greatest diameter of the body, which is 3 $\frac{1}{4}$  in the total length of the body. The length of the falcated pectorals equals that of the head. Single individuals occur at Pinang at all seasons. They appear nearest to correspond to the description of *C. forsteri*.

#### CARANX MALABARICUS, (Bloch-Schneider.)

*Scomber malabaricus*, Bloch-Schn. p. 31.

Russell, CL. Tallam Parah.

*Caranx malabaricus*, Cuv. and Val. IX. 121.

*Caranx malabaricus*, Richardson, Report, 1845, 275.

Head above and back pale silvery sea green; sides of the head and body shining silvery with blue reflections; abdomen white; at the upper part of the opercle a bluish black spot; pectorals, second dorsal and caudal yellowish white, the two latter sparingly dotted with black towards the margin; anal and ventrals white; first dorsal hyaline. Iris silvery, minutely dotted with brown; upper orbital margin bluish black.

D 8—1/22, C 17 $\frac{1}{2}$ , A 2—1/18, V 1/5, P 20, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Coromandel, Bay of Bengal, Red Sea, China Sea.

TOTAL LENGTH: 8 inch.

The length of the head is 3 $\frac{1}{4}$  in the total, measured to the centre of

the posterior margin of the caudal; the depth at occiput equals the length. The transversal diameter of the orbit is a little less than  $\frac{1}{2}$  of the length of the head. The teeth of both jaws, of the vomer and the palatals are velvety, but those on each side of the symphysis of the jaws are a little longer than the rest. The tongue is very small, linear, and with the exception of the apex, covered with velvety teeth. The arched portion of the slightly undulating lateral line terminates opposite the posterior third of the second dorsal; the straight portion is covered by 35 to 36 plates, none of which exceeds  $\frac{1}{10}$  of the greatest vertical diameter of the body, which is about  $2\frac{1}{2}$  in the total length. The pectorals equal the length of the head. Single individuals occur at Pinang at all seasons, and are eaten, fresh or dried, by the natives.

*CARANX NIGRIPES*, Cuv. and Val.

Russell, CLII. Mais Parah.

*Caranx nigripes*, Cuv. and Val. IX. 122.

*Caranx nigripes*, Richardson, Report, 1845, 275.

*Caranx nigripes*, Bleeker: Verh. Batav. Gen. XXII. 4.

Head above and back pale silvery blue or green; sides of the head and body shining silvery with rose coloured reflections; abdomen white: on the upper part of the opercle an indistinct bluish black spot; base and anterior margin of ventrals white, rest greenish black, and between these fins a black spot; first dorsal greyish, minutely dotted with black; the rest of the fins white, the second dorsal and caudal minutely dotted with black towards the margin; at the symphysis of the lower jaw a black spot; branchiostegous rays and membrane silvery white, the latter broadly brimmed with black between the four lower rays. Iris silvery, upper orbital margin bluish black.

D 8—1/21 or 22, C 17 $\frac{1}{2}$ , A 2—1/18, 19 or 20, V 1/5, P 19, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Coromandel, Bay of Bengal, Java, Balli, Madura, China

Seas.

TOTAL LENGTH: 6 inch.

The length of the head is  $3\frac{1}{2}$  in the total, measured to the centre of the posterior caudal margin; the depth at occiput exceeds by  $\frac{1}{2}$  the length. The transversal diameter of the eye is  $3\frac{1}{2}$  in the length of the head. The greatest vertical diameter of the body is  $2\frac{1}{2}$  in the total length. The horizontal, immoveable, spine in front of the first

dorsal, is rather strong, with the point free. The arched portion of the lateral line terminates opposite the fifth ray of the second; the straight portion is covered by about 36 or 37 slightly pointed plates, none of which exceeds  $\frac{1}{8}$  of the greatest diameter of the body. The length of the falcated pectorals is  $3\frac{1}{2}$ , that of the ventrals is  $4\frac{1}{2}$  in the total. The length of the ventral spine is  $2\frac{1}{2}$  in the nearest ray. The point of the second dorsal and anal fin is  $3\frac{1}{2}$  in the greatest vertical diameter of the body. Behind the eyes appear some indistinct scales; the cranial crest, the rest of the head and the thorax are scaleless; the rest of the body is covered by small orbicular, somewhat deciduous scales.

This species is at all times excessively numerous in the Straits of Malacca and the Bay of Bengal. The natives eat it in its fresh and dried state.

*CARANX ATROPUS*, (Bloch-Schneider).

*Brama atropus*, Bloch-Schneider, 98, Pl. 23.

*Olistus atropus*, Cuv. and Val. IX. 141.

D 8—1/21, C  $17\frac{1}{2}$ , A 2—1/17, V  $1\frac{1}{5}$ , P 19, Br. VII.

HABIT.—*Sea of Pinang.*

Tranquebar.

TOTAL LENGTH:  $7\frac{1}{2}$  inch.

In proportions, number of fin rays and colours this fish exactly resembles *Caranx nigripes*, from which it merely differs in having the 6th, 7th, 8th, 9th, 10th, 11th, and 12th rays of the second dorsal longer than the rest, and the elongated part not connected by the membrane. The 8th and 9th are the longest, each being about  $2\frac{1}{2}$  in the greatest vertical diameter of the body. All the elongated rays, although filamentous, are distinctly branched, which consequently excludes the fish from the genus *Olisthus*.\* The elongated part, as well as the half of the membrane in front of each ray, is minutely dotted with black. However erroneous Bloch's description and figure of *Brama atropus* may be, there seems to be no reason to doubt that a specimen of the present fish was his original. M. M. Cuvier and Valenciennes observe that the specimen now extant, marked by Bloch: *Brama atropus*, (his specimen of *Caranx nigripes* is labeled:

\* OLISTHUS, Cuv. (R. A. 1829.) Differs from *Caranx*, (*Citula*) in having the middle rays of the second dorsal not branched, but merely articulated, and each elongated into a filament.

*Brama melampus*,) is nothing but *Caranx nigripes*. Mutilation of the delicate filaments of *C. atropus* would indeed render it indistinguishable from *C. nigripes*. A single individual of the present was observed at Pinang in June, 1844, and it remains to be ascertained if the elongation of some of the dorsal rays is more than an individual distinction. Dr. Rüppell obtained in the Red Sea a specimen of his *Citula ciliaris* (Syn. *Olistus* ? *rupellii*, Cuv. and Val.) which had the middle rays of both the second dorsal and of the anal fin elongated filamentous, and he therefore thinks it possible that the fish is identical with *Olistus malabaricus*, Cuv. and Val. (Neue Wirbelth. Fische: p. 50).

#### CARANX ARMATUS, (Rüppell.)

*Scisena armata*, Forskål, Fauna Arab. p. 53, No. 68 ?

*Scisena armata*, Linné, Syst. 1306 ?

Russell, CLI. Tchawil Parah. (*Young*.)

*Citula armata*, Rüppell: Atlas, 103.

*Caranx citula* (cirrhosus, Ehrenb.) Cuv. and Val. IX. 126, Pl. 250.

*Caranx armatus*, Cuv. and Val. IX. 127.

*Caranx ciliaris*, Cuv. and Val. IX. 129. (*Young*.)

*Citula armata*, (Syn. *Caranx cirrhosus*,) Rüppell, Neue Wirb. Fische 50.

*Caranx ciliaris*, Temm. et. Schl. Fauna Japon. Pisc. 112.

*Caranx ciliaris*, Richardson, Report, 1845, 276.

*Young*. Head above and back pale sea green or bluish green; sides of the head and of the body beneath the lateral line mother-of-pearl with pale rose coloured reflections; abdomen white; an indistinct black spot at the upper part of the opercle; first dorsal hyaline minutely dotted with black; second dorsal yellowish white, the elongated point and the upper margin minutely dotted with black; caudal yellowish white, marginal half minutely dotted with black; anal and pectorals white; base and anterior margin of the ventrals white, rest pale greenish grey, minutely dotted with brown. Iris silvery, upper orbital half greenish black.

D 8—1/21, C 17½ A 2—1/16 or 17, V 1/5, P 19, Br. VII.

HABIT.—*Sea of Pinang, Singapore.*

Seas of China and Japan, New Guinea, Java, Coromandel, Red Sea, Indian Ocean.

**TOTAL LENGTH :**  $4\frac{1}{4}$  inch.

The length of the head is  $3\frac{1}{2}$  in the total, measured to the centre of the caudal fin ; the depth at occiput exceeds by  $\frac{1}{2}$  the length. The diameter of the orbit is  $\frac{1}{2}$  of the length of the head. The greatest vertical diameter of the body, in front of the second dorsal, is  $2\frac{1}{2}$  in the total length. The arched portion of the lateral line does not abruptly become straight ; it straightens a little in front of and opposite the third posterior part of the second dorsal, and is covered by about 24 plates, none of which exceeds  $\frac{1}{2}$  of the greatest vertical diameter of the body. The elongated first dorsal ray exceeds by about  $\frac{1}{2}$  the greatest vertical diameter of the body ; the first anal ray scarcely exceeds  $\frac{1}{2}$  of the first dorsal, but is frequently less. The point of the horizontal spine, in front of the first dorsal fin, is exposed. The length of the falcated pectorals is  $\frac{1}{2}$  of the total length ; the ventrals slightly exceed  $\frac{1}{2}$  of the pectorals. This species is of uncommon occurrence at Pinang. It corresponds exactly to Russell's No. CLI. (*Caranx ciliaris*, Cuv. and Val.) which would appear to be the young of *Citula armata*, which Dr. Rüppell considers to be identical with *Caranx citula* (*cirrhorus*, Ehrenb.) Cuv. and Val. The description of the latter affords no specifically distinguishing characters.

**CARANX OBLONGUS, Cuv. and Val.**

*Caranx oblongus*, Cuv. and Val. IX.

*Young.* Head above and back pale yellowish green ; sides of the head and body beneath the lateral line shining silvery ; abdomen white ; first dorsal hyaline, sparingly dotted with brown ; second dorsal and anal hyaline, the marginal half minutely dotted with brown, the elongated points of the fins bright yellow ; ventrals and caudal yellow, the margin of the latter minutely dotted with black ; pectorals white. Iris golden light green ; upper half of orbital margin bluish black.

D 8— $1/22$ , C  $17\frac{1}{2}$ , A 2— $1/19$ , V  $1/5$ , P 21, Br. VII.

**HABIT.**—*Sea of Pinang.*

Vanicolo, Oualan.

**TOTAL LENGTH :**  $5\frac{1}{2}$  inch.

The length of the head is  $\frac{1}{2}$  of the total, measured to the centre of the posterior margin of the caudal ; the depth at occiput slightly exceeds the length of the head, of which the diameter of the orbit is  $\frac{1}{2}$ .



Of the velvety teeth those of the symphysis of both jaws are somewhat stronger than the rest. The greatest vertical diameter of the body in front of the second dorsal is  $2\frac{1}{2}$  in the total length, measured to the centre of the posterior margin of the caudal. The lateral line is slightly arched, following the profile of the back it terminates opposite the second third of the dorsal. The straight portion is covered by 40 strongly keeled plates, none of which exceed  $\frac{1}{2}$  of the greatest vertical diameter of the body. The point of the horizontal spine in front of the first dorsal is exposed. The elongated anterior ray of the second dorsal exceeds by  $\frac{1}{2}$  the greatest vertical diameter of the body, of which the anterior ray of the anal is but  $\frac{2}{3}$ . The falcated pectorals equal the lobes of the caudal, and are  $2\frac{1}{2}$  in the total length. The ventrals are  $\frac{1}{2}$  of the pectorals. A single individual occurred at Pinang in September, 1843.

**CARANX SPECIOSUS, (Forskål.)**

*Scomber speciosus*, Forskål, Fauna Arab. 54, No. 70.

*Scomber speciosus*, Linné, Syst. 1332.

Lacépède, III. Tab. 1, Fig. 1.

Russell, CXLIX. Poloosoo Parah.

*Scomber speciosus*, Shaw, IV. 603.

*Caranx à six bandes*, Quoy et Gaim. Tab. 65, Fig. 4.

*Caranx speciosus*, Rüppell, Atlas, 96.

*Caranx speciosus*, (Syn. *C. petaurista* : Isid. Geoff. Eg. Tab. XXV.

Fig. 1. *Adult.*) Cuvier, R. A. II. 209 (')

*Caranx speciosus*, Cuv. and Val. IX. 130.

*Caranx speciosus*, Rüppell : Neue Wirbelth. Fische, 45.

*Zonichthys subcarinata*, Swainson : II. 248.

*Caranx speciosus*, Bleeker : Verh. Batav. Gen. XXII. 4.

Ground colour citrine or king's-yellow with a bluish black oblique band from the centre of the orbit to the occiput ; a second from the occiput vertically over the posterior margin of the opercle ; a third narrow line from in front of the first dorsal to a little below the lateral line ; a fourth broad band from the middle of the first dorsal to abdomen ; a fifth narrow line from between the dorsals ; a sixth broad band from the anterior part of the second dorsal ; a seventh narrow line from the middle ; an eighth broad band from the posterior part ;

and a ninth narrow line from the termination of the second dorsal; the posterior three alternate bands and lines reaching the abdomen; in some a bluish black spot at the root of the pectorals; branchiostegous rays and membrane, the two spines in front of the anal and the ventrals white; the rest of the fins citrine, the dorsals minutely dotted with black, the points of the caudal and the posterior margin black. Iris golden citrine, upper orbital margin bluish black.

D 7—1/19 or 20, C 17½, A 2—1/15 or 16, V 1/5, P 22, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

New Holland, Vanicolo, Isle of France, Red Sea,

Trincomalie, Coromandel, Java, Madura.

TOTAL LENGTH : 9 inch.

The length of the head is  $3\frac{1}{2}$  in the total, measured to the centre of the posterior margin of the caudal; the depth at occiput equals the length. The diameter of the orbit is  $\frac{1}{4}$  of the length of the head. In individuals not exceeding  $3\frac{1}{4}$  inches in length, velvety teeth may be felt on each side on the symphysis of the upper jaw; on each side of the symphysis of the lower they may distinctly be seen, and a single series of from 10 to 12 rather distant teeth appear across the vomer. In an individual 9 inches in length no teeth appeared except a small, yet distinct, one on each side of the symphysis of the lower jaw. The greatest vertical diameter of the body, in front of the second dorsal, is  $\frac{1}{2}$  of the total length. The arched portion of the lateral line terminates, but not abruptly so, a little in front of and opposite the middle of the second dorsal fin. The straight portion is covered by upwards of 34 slightly keeled plates, of which none of the posterior 12, the largest, exceeds  $\frac{1}{4}$  of the greatest vertical diameter of the body. The length of the falcated pectorals equals that of the head. Single individuals occur at Pinang at all seasons. They are eaten by the natives.

GEN. SCYRIS, Cuvier, 1829.

Differs from *Caranx* by a more elevated, trenchant profile; first dorsal entirely hid; second dorsal with some of the rays elongated, filamentous.

SCYRIS INDICUS, Rüppell.

*Scyris indicus*, Rüppell: Atlas, 128, Tab. 33, Fig. 1. (*Young.*)

*Scyris indica*, Cuv. and Val. IX. 145, Pl. 252. (*Adult.*)

*Scyris indicus*, Rüppell: Neue Wirbelth. Fische, 51.

*Scyris rüppelli*, (Young) } Swainson, II. 251.  
*Scyris indicus*, (Adult) }

*Scyris indica*, Richardson, Report, 1845, 276.

Head above and back blackish silvery; cheeks and opercles shining silvery, the latter minutely and sparingly dotted with brown; at the upper part of the posterior margin of the opercle a small intensely black spot; the rest of the body silvery satin, abdomen sparingly dotted with brown; fin-rays and membranes yellowish white; upper margin of the second dorsal and posterior margin of the caudal minutely dotted, so as to appear blackish; root of the pectoral silvery. Iris silvery, upper orbital half bluish black.

D 1/19, C 17½, A 1/16, V 1/5, P 19, Br. VII.

HABIT.—*Sea of Pinang*

Java, Pondicherry, Red Sea, China Seas.

TOTAL LENGTH: 1 foot 9 inch.

The length of the head is  $3\frac{1}{2}$  in the total, measured to the centre of the posterior margin of the caudal; the depth at occiput is but  $\frac{1}{2}$  of the total length. The diameter of the orbit is  $\frac{1}{4}$  of the length of the head. In both jaws appear two or three series of small, but strong, conical teeth resembling those of some *Sparoidæ*; those on each side of the symphysis are larger than the rest. The vomer presents a few similar, but the small, oblong, tongue is covered with card-like teeth. The greatest vertical diameter of the body, in front of the dorsal fin, is  $2\frac{1}{2}$  in the total length. Each of the small scales composing the lateral line has a central longitudinal tube, from the posterior part of which branch off two smaller ones: one upwards and backwards, the other downwards and backwards. The arched, somewhat undulating portion of the line terminates opposite the middle of the dorsal fin. The straight portion consists mostly of small scales, but towards the termination of the dorsal the posterior eleven gradually enlarge and become sharply keeled; the three or four last, although the largest, do not exceed  $\frac{1}{12}$  of the greatest vertical diameter of the body. In the adult the cranial crest is very large and arched, like that observed in *Platax arthriticus*, but the posterior part, from opposite the opercle, is not contiguous, but consists of three separate, gradually decreasing, egg-shaped pieces of bone. Behind the last, lie six successive pieces, entirely hid under the integuments, and resting on the interspinals. The ante-

rior undulating dorsal ray is the longest, slightly exceeding the length of the head. This, as well as the three succeeding, gradually decreasing ones, are undivided; the fifth and sixth are branched like the following, but their anterior branch is undivided and slightly elongated. The anterior anal ray equals in length the corresponding dorsal, and is as well as the second undivided. In front of the anal fin lie two small distant spines entirely concealed under the integuments. The length of the falcated pectorals is  $\frac{1}{2}$  of the body, not including the caudal; that of the ventrals a little less than  $\frac{1}{2}$  of the pectorals. Single individuals are of very rare occurrence at Pinang.

GEN. GALLICHTHYS, Cuv. and Val. 1833.

Body high and compressed; profile much elevated; ventrals elongated; caudal furcated; first dorsal fin very low or reduced to a series of short spines; anterior rays of second dorsal and anal excessively elongated.

GALLICHTHYS MAJOR, Cuv. and Val.

Russell, LVII. Gurrah Parah.

Gallichthys major, Cuv. and Val. IX. 168, Pl. 254.

Blepharis gallichthys, Swainson, II. 250.

Gallichthys major, Richardson, Report, 1845, 271.

Head above and back blackish silvery; cheeks and opercles shining silvery; at the upper part of the latter an indistinct bluish spot; rest of the body silvery satin; fin-rays and membranes yellowish white; elongated portion of the dorsal and anal, upper margin of the dorsal and posterior of the caudal minutely dotted with black; dorsal and anal filaments, and ventral fins black. Iris silvery, upper orbital half bluish black.

D 6— $\frac{1}{18}$  or 19, C  $17\frac{2}{3}$ , A 2— $\frac{1}{16}$ , V  $\frac{1}{5}$ , P 19, Br. VII.

HABIT.—*Sea of Pinang, Singapore.*

Coromandel, Moluccas, China Sea.

TOTAL LENGTH: 6 inch.

The length of the head is  $\frac{1}{3}$  of the total, measured to the centre of the posterior margin of the caudal; the depth at occiput is nearly double the length of the head. A narrow band of velvety teeth appears in both jaws and on the vomer. The diameter of the eye is  $\frac{1}{3}$  of the length of the head. The greatest vertical diameter of the body is  $1\frac{1}{2}$  in the total length. The lateral line in its component scales, and

its course exactly resembles that of *Scyris indicus*. The length of the anterior ray and its hairlike filament, of the second dorsal, anal, and ventral fins equals the length of the body; it is, however, liable to individual variations. The four anterior rays of the second dorsal are undivided, and as well as the five succeeding branched rays, terminate in gradually decreasing hairlike filaments. The two anterior anal rays are undivided, and as well as the third, which is branched, terminate in similar filaments. The anterior ventral ray is undivided, and, as well as the second, which is branched, filamentous. The length of the falcated pectorals and of the caudal lobes is  $2\frac{3}{4}$  in the total. Single individuals are rarely seen at Pinang.

GEN. SERIOLA, (*Risso*,) *Cuvier* 1829.

Two dorsals, no spurious fins; tail without keel or crests; jaws, vomer and palatals with velvety or card-like teeth. Differs from *Caranx* by the not mailed lateral line; from *Lichia* by the membrane uniting the spines of the first dorsal.

SERIOLA BINOTATA, Cuv. and Val.

*Seriola binotata*, Cuv. and Val. IX. 215.

Head above, back and sides to the lateral line yellowish green; sides of the head and body beneath the lateral line greenish yellow, abdomen bluish white or green; dorsals greenish yellow; a black vertical band above the eye, a second broader from occiput over the opercle; a third from between the second and fourth spine of first dorsal down towards the pectoral; a fourth from the point of second dorsal to the side below the lateral line; a fifth from the middle of the second dorsal to the lateral line; a sixth from the posterior part of the second dorsal; a seventh in front of the upper half of the root of the caudal; between the bands some round and irregular black spots; caudal yellow with a round black spot in the centre and an oval over each lobe, the point of which is yellowish white; anal light bluish green, lower half black, anterior and posterior angle yellowish white; ventrals light bluish green, posterior half black, point of anterior ray yellowish white; pectorals pale yellow. Iris light golden green, orbital margin blackish.

D 7— $1/32$  or 33, C 17 $\frac{1}{2}$ , A 2— $1/15$ , 16 or 17, V  $1/5$ , P 19, Br. VII.

HABIT.—*Sea of Pinang, Singapore.*

Pondicherry, Bay of Bengal.

TOTAL LENGTH:  $4\frac{1}{2}$  inch.

The length of the head is  $3\frac{1}{2}$  in the total, measured to the centre of the posterior margin of the caudal; the depth at occiput is a little less than the length of the head. The diameter of the eye is  $\frac{1}{2}$  of the length of the head. The forehead between the eyes is arched, not trenchant. The angle of the mouth is opposite the posterior margin of the orbit. The card-like teeth of the jaws, vomer and palatals are rather large, recurvous; those of the tongue velvety. The greatest vertical diameter of the body, in front of the first dorsal, slightly exceeds the length of the head. No immoveable spine is perceptible in front of the first dorsal fin. The anterior third of the lateral line is a little arched, the rest nearly straight. The first dorsal is small: its height but  $\frac{1}{2}$  of the greatest vertical diameter of the body; the point of the second dorsal is more than double the height of the former. The length of the ventrals equals that of the head; the anterior half of the fifth ray is connected to the abdomen by a membrane. The length of the pectorals is  $\frac{1}{2}$  of that of the body, the caudal not included. The caudal lobes are  $\frac{1}{2}$  of that distance. Single individuals occur rarely at Pinang. This species greatly resembles *Seriola nigrofasciatus* (Rüppell,)\* from which it, however, may at once be distinguished by the remarkably shorter distance between the first and second dorsal.

GEN. LACTARIUS, Cuv. and Val. 1833.

(PLATYLEPIS, Swainson 1839.)

Differs from *Seriola* in having one or two long arched teeth on each side of the symphysis of the upper jaw; in having a single series of fine teeth in the lower, and on the symphysis one or two longer ones; and in the absence of free spines in front of the anal fin.

LACTARIUS DELICATULUS, Cuv. and Val.

*Scomber lactarius*. Bl.-Schn. 31, No. 26.

Russell CVIII, Chundawah.

*Seriola lactaria*, Cuv. R. A. II. 206.

*Lactarius delicatulus*, Cuv. and Val. IX. 238, Pl. 261.

*Platylepis lactaria*, Swainson, II. 247.

*Lactarius delicatulus*, Richardson Report 1845, 272.

*Lactarius delicatulus*, Bleeker: Verh. Bat. Gen. XXII. 4.

Head above, back and sides to the lateral line greenish grey or lead

\* SYN. *Nomeus nigrofasciatus*, Rüppell, Atlas, 82 Pl. 24, Fig. 1.—*Seriola rüppelli*, Cuv. and Val. IX. 216.

coloured ; the rest shining silvery ; a black spot at the upper part of the posterior margin of the opercle ; fins hyaline, marginal half of dorsals and caudal minutely dotted with black. Iris silvery, upper half of orbital margin black.

D 8—1/21 or 22, C 17½, A 3/25, 26 or 27, V 1/5, P 16, Br. VII.

**HABIT.**—*Sea of Pinang, Malayan Peninsula Singapore.*

Coromandel, Bay of Bengal, mouths of the Ganges, Malabar, Java, Madura,

**TOTAL LENGTH :** 4½ inch.

The length of the head is ½ of the total, measured to the centre of the posterior margin of the caudal ; the diameter of the eye is 3½ in the length of the head. The greatest vertical diameter, in front of the first dorsal, equals the length of the head. The lateral line follows at the upper third of the body the outline of the back. The scales of the lateral line and the body are rather large, orbicular, very thin and deciduous. This species is excessively numerous at all seasons. It is eaten both fresh and dried.

**GEN. STROMATEUS, (Artedi,) Linné. 1748.**

Ventral fins none ; dorsal single with the spines hid in the anterior margin ; vertical fins covered with scales.

#### **STROMATEUS NIGER, Bloch.**

*Stromateus paru*, Bloch Pl. 160.

*Stromateus niger*, Bloch Pl. 422.

*Stromateus paru*, Linné : Syst. 1148.

*Stromateus paru*, Shaw IV. p. 108, (Bloch Pl. 160.)

*Stromateus niger*, Shaw *ibid.* 111.

*Stromateus niger*, Russell, p. 35, No. XLIII. Nalla Sandawah.

*Stromateus niger*, S. paru, Cuv. R. A. II. 213 (°)

*Stromateus niger*, Cuv. and Val. IX. 385.

*Stromateus niger*, Cantor : Ann. and Mag. N. H. IX. 15.

*Stromateus niger*, Richardson Rep. 1845, 272.

*Stromateus niger*, Bleeker : Verh. Bat. Gen. XXII. 4.

Bawar or Bawal tumbak of the Malays.

Head above, back and sides dark greyish brown with blue reflections ; cheeks, opercles and abdomen silvery light bluish grey or pale neutral tint ; dorsal and anal silvery bluish grey, blackish towards the

margin; pectorals and caudal yellowish light grey, edged with blackish. Iris silvery blackish or brownish blue.

D 1/42 or 43, C 17½, A 1/37 or 38, P 23, Br. VI. (VII?)

HABIT.—*Sea of Malayan Peninsula and Islands.*

Chusan, Macao Coromandel, Bay of Bengal, Bombay,  
Java, Celebes, Madura.

TOTAL LENGTH: 1 foot.

The length of the head is  $3\frac{1}{2}$  in the total, measured to the centre of the posterior margin of the caudal. The diameter of the eye is  $\frac{1}{2}$  of the length of the head. In each jaw appears a single series of excessively minute teeth. The greatest vertical diameter of the body, from the middle of the point of the dorsal to the anal, is a little less than  $\frac{1}{2}$  of the total length. The lateral line, at the upper third of the body, follows the outline of the back to a little in front of the dorsal, from whence it proceeds straight to the caudal. It is raised, like a thin cord; the tail is distinctly keeled. The dorsal fin is preceded by four or five, the anal by four short spines, which, however, are completely hid by the integuments. The length of the falcated pectorals is a little more than  $2\frac{1}{2}$  in the total. The lobes of the caudal equal the length of the head. This species, "*the black pomfret*," is at all seasons taken in abundance in the Straits of Malacca, where, however, it is considered inferior to *Stromateus sinensis*, "*the white pomfret*." In dried state it is largely exported, and thus it appears in the bazaars of Hindustan, which are chiefly supplied from Bombay.

#### STROMATEUS SINENSIS, Euphrasén.

*Stromateus sinensis* Euphrasén: Act. Acad. Stockh. IX. 49, Tab. 9.

*Stromateus atoo-koia*, Russell, p. 35. No. XLIV. Atoo Koia.

*Stromateus albus*, Cuv. R. A. II. 213 (?)

*Stromateus albus*, Cuv. and Val. IX. 388.

*Stromateus atous*, Cuv. and Val. l. c. 389.

*Stromateus albus*, Cantor, Ann. Nat. Hist. IX. 15.

*Stromateus atous*, Richardson Report 1845, 273.

Bawar or Bawal chirmin of the Malays.

*Young.* Head above and back reddish brown; rest of the body and fins lighter, silvery, with a mixture of ventral tint, lilac or blue; dorsal, anal, and caudal with the marginal half blackish; everywhere with



brown dots of different sizes : the larger with a silvery point in the centre.

*Adult.* Head above, back and sides to the lateral line deep neutral tint ; rest of the body with a mixture of brownish grey with metallic reflection, lighter, silvery towards abdomen ; everywhere dotted as the young ; large patches of milkwhite naked skin, where the scales have disappeared ; fins silvery grey, marginal half blackish ; cavity of the mouth and tongue pale bluish grey with brown dots, silvery in the centre. Iris reddish silvery or copper-coloured, minutely dotted with brown.

D 1/43 to 46, C 17½, A 1/39 to 42, P 26 or 27, Br. VI.

*HABIT.*—*Sea of Malayan Peninsula and Islands.*

Coromandel, Bay of Bengal, Macao, Chusan.

**TOTAL LENGTH :** 10 inch.

The length of the head is 4½ in the total, measured to the centre of the posterior margin of the caudal. The diameter of the eye is a little less than ¼ of the length of the head. The lower jaw projects a little beyond the upper : in both appears a single close series of excessively minute teeth. The thread-like lateral line, at the upper fifth of the body, follows the outline of the back to the termination of the dorsal fin, from whence it proceeds straight, along the upper third of the tail to the caudal. The scales of the body are small, orbicular and so deciduous that the fish generally appears with large patches of milk-white naked skin. The greatest vertical diameter of the body, from the middle of the point of the dorsal to that of the anal fin, exceeds by ½ half the total length. The pectorals are broad, pointed but not falcated, and project from the body ; their length is 3½ in the total. The length of the broad triangular caudal lobes equals that of the head. Both the dorsal and anal fin are preceded by four spines completely hidden by the integuments. As in *Stromateus fiatola*, Linné, and in *S. argenteus*, Bloch, the fleshy oesophagus is armed with numerous bony, barbed, spines or teeth. In the stomach of those examined appeared remains of fishes. This is par excellence the "*white pomfret*" of the Straits Settlements and Madras, "*pample blanche*" of Pondicherry. It is justly renowned for its flavour, but it requires to be freshly taken when used. In the Straits and on the Coromandel Coast it is abundant at all seasons. At the Sandheads in the Bay of Bengal, (21° N. L.) it occurs, but less numerously. Russell happened seldom

to see this species and considered it very inferior to the "black" (*Stromateus niger*, Bloch) or "white pomfret," by which latter Russell means *Stromateus argenteus*, Bloch. (Russell p. 34.)

**STROMATEUS ARGENTEUS, Bloch.**

*Stromateus argenteus*, Bloch, Pl. 421.

*Stromateus argenteus*, Shaw IV. 110.

*Stromateus argenteus*, Russell p. 31, 35, No. XLII. Tella Sandawa.

*Stromateus candidus*, Cuv. R. A. II. 213 (\*)

*Stromateus candidus*, Cuv. and Val. IX. 391.

*Stromateus argenteus*, Cuv. and Val. IX. 393.

*Stromateus securifer*, Cuv. and Val. IX. 394, Pl. 273 (Young.)

*Stromateus candidus*, Bélanger, 369, Pl. II. Fig. 2.

*Stromateus securifer*, Cantor Ann. Nat. Hist. IX. 15.

*Stromateus securifer*, Richardson Report 1845, 273.

*Stromateus candidus*, Bleeker : Verh. Bat. Gen. XXII. 4.

Head above back and sides to the lateral line neutral tint with purple reflections; sides of the head and body beneath the lateral line silvery grey, everywhere with minute black dots, disposed on the sides of the occiput, and the upper half of the body so as to produce alternate indistinct, blackish and silvery grey-undulating, irregular lines; on the upper part of the opercle an irregular black spot; abdomen silvery white; dorsal and anal silvery, minutely dotted with black so as to render the point and marginal half blackish; caudal and pectorals yellowish white, minutely dotted with black so as to make the posterior half and the margins blackish; cavity of the mouth and tongue as in *S. sinensis*. Iris silvery, minutely dotted with black.

D 9—1/39 to 43, C 17½, A 6—1/34 to 38, P. 25, Br. VI.

**HABIT.**—*Sea of Malayan Peninsula and Islands.*

Malabar, Coromandel, Bay of Bengal, Macao, Chusan,  
Java, Madura.

**TOTAL LENGTH:** 9 inch.

The length of the head is  $4\frac{1}{2}$  in the total, measured to the centre of the posterior margin of the caudal. The diameter of the eye is  $3\frac{1}{2}$  in the length of the head. The muzzle is a rounded protuberance which considerably projects beyond the mouth. Both jaws have a single close series of excessively minute teeth. The naked skin of the upper

part of the head and the anterior part of the back is longitudinally wrinkled. The lateral line follows a similar course to that of *S. chinensis*, and the scales of the body are equally deciduous. The points of the dorsal and anal are more falcated and as well as the lobes of the caudal and the pectorals more elongated than in the former species. The length of the point of the anal, slightly exceeding that of the dorsal, equals the pointed pectorals which as well as the caudal lobes are  $\frac{1}{2}$  of the total length. The greatest vertical diameter of the body between the commencement of the dorsal and anal fin, exceeds by  $\frac{1}{2}$  half the total length. The dorsal fin is preceded by nine truncated processes of which each has one forwards and one backwards directed spine; the anal is preceded by six similar ones, differing, however, in having the longer spine pointing backwards. In young individuals these spines are much more distinct than in the adult, and in this stage the fish has been described as *Stromateus securifer*.—*Stromateus argenteus*, Euphrasén,—*Stromateus aculeatus*, Bloch-Schneider, is probably also the young of this species. In the adult fish the anterior two or three of the truncated dorsal processes are completely hidden by the integuments, and the rest are barely piercing the back, so as to be more readily felt than seen. Although they escaped the observation of Bloch, Russell correctly identified his No. XLII. *Tella Sandawa*, with Bloch's Pl. 421. In the Straits Settlements as well as at Madras, also this species is denominated the "*white pomfret*." In abundance and excellence it vies with *S. sinensis*.

**STROMATEUS CINEREUS, Bloch.**

*Stromateus cinereus*, Bloch Pl. 420.

*Stromateus cinereus*, Shaw IV. 109.

Russell XLV. Sudi Sandawah.

*Stromateus sudi*,  
*Stromateus cinereus*, } Russell p. 35.

*Stromateus griseus*, Cuv. R. A. II. 213 (\*)

*Stromateus griseus*, Cuv. and Val. IX. 395.

Head above, back and sides to the lateral line lead grey; cheeks and opercles silvery, slightly dotted with black; an irregular black spot on the upper part of the opercle; sides beneath the lateral line silvery grey; abdomen silvery white; dorsal and anal silvery grey, minutely dotted with black; their elongated points and margins blackish; caudal

yellowish white, minutely dotted with black, margins and posterior part of the lobes blackish; pectorals buff, upper margin and posterior half minutely dotted with black; cavity of the mouth and tongue as in *S. sinensis*. Iris silvery, orbital half lead grey.

D 7 or 8— $1/39$  to 41, C 17 $\frac{1}{2}$ , A 5— $1/32$  to 39, P 23 to 25, Br. VI.

HABIT.—*Sea of Malayan Peninsula and Islands.*

Coromandel, Bay of Bengal.

Length of the body, ..... 4 inch.  
 „ of the lower caudal lobe, ..... 4 „

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TOTAL LENGTH: 8 inch.

The length of the head is  $\frac{1}{4}$  of the total, measured to the centre of the posterior margin of the caudal. The diameter of the eye is  $\frac{1}{4}$  of the length of the head. The muzzle forms a large rounded protuberance projecting over the mouth. Each jaw has a close series of excessively minute teeth. The lateral line is situated as in *S. sinensis* and *argenteus*. The scales of the body are small, orbicular and so deciduous that the fish generally appears scaleless. The truncated processes preceding the dorsal and anal fin resemble those of *S. argenteus*, from which the present may readily be distinguished by the far greater elongation of the lower lobe of the caudal, and of the falcated point of the anal fin. The falcated point of the dorsal equals the length of the pointed pectorals, which are  $2\frac{1}{2}$  in the total length. The upper caudal lobe is but  $\frac{1}{4}$  of the lower, which equals the length of the body, the caudal not included. The length of the falcated point of the anal fin in some individuals equals the lower caudal lobe, in others it is but  $\frac{2}{3}$  of the latter. The greatest vertical diameter of the body, between the commencement of the dorsal and anal fin, exceeds by  $\frac{1}{2}$  half the total length. At Pinang this species is as abundant as the preceding, but probably from its inferior size it is considered somewhat inferior in quality. At the Sandheads it occurs rarely.

GEN. CYRTUS, Bloch 1787.

Body compressed; back greatly elevated with several small treacherant blades in front of the dorsal; between the ventrals on the pelvis a horizontal, backwards directed spine; scales excessively minute, transparent; ribs dilated, convex, forming rings in contact with each other and producing a conical cavity.

## CYRTUS INDICUS, Bloch.

*Kurtus indicus*, Bloch Pl. 169.

*Kurtus indicus*, Linné, Syst. 1184.

*Kurtus blochii*, Lacép, II. 516 and 517. } (*Female* ?)

*Kurtus indicus*, Shaw IV. 185, Pl. 25.

Russell XLVIII. Somdrum Kara Mooddee. (*Male* ?)

*Kurtus indicus*, Cuv. R. A. II. 215. (*Female* ?)

*Kurtus cornutus*, Cuv. l. c. (*Male* ?)

*Kurtus blochii*, Cuv. and Val. IX. 421, Pl. 277. (*Female* ?)

*Kurtus cornutus*, Cuv. and Val. IX. 426. (*Male* ?)

*Kurtus blochii*, Swainson II. 253.

*Kurtus blochii*, Bleeker : Verh. Bat. Gen. XXII. 4.

Head above and body flesh-coloured, hemitransparent ; back minutely and closely dotted with black, forming immediately behind the occiput a large rounded spot, from which in some (the males ?) projects the black, downwards arched, horn-like process ; opercles and jaws silvery, with steel blue reflections ; abdomen silvery with rose-coloured, lilac and golden reflections ; pectorals and ventrals whitish, the rest of the fins pale reddish or whitish yellow, minutely dotted with black. Iris silvery, upper orbital margin blackish.

D 8—2/13, C 17½, A 2/33 or 34, V 1/5, P 23, Br. VII.

HABIT.—*Sea of Malayan Peninsula and Islands.*

Java, Madura, Coromandel, Sandheads.

TOTAL LENGTH : 5 inch.

The length of the head in a straight line from the symphysis of the lower jaw, is  $\frac{1}{4}$  of the total, measured to the centre of the posterior margin of the caudal, but taken obliquely upwards to the membranous angle of the opercle, it is but  $\frac{1}{4}$  of the total, and equals the depth at occiput. The diameter of the eye is  $\frac{1}{4}$  of the former length of the head. In each jaw is a band of card-like teeth : in the upper immediately under the symphysis is a naked excavated space, which receives from the lower a corresponding protuberance, covered with teeth ; on the vomer and the palatals appears a single series of excessively minute velvety teeth. On the inferior margin of the preopercle appear three strong backwards arched spines, of which the posterior is the longest and somewhat removed from the others. The angle of the opercle projects

far back, and is excessively thin, membranous, supported by four or five backwards radiating rays, the points of which are exposed. In those, supposed by Cuvier to be males, projects immediately behind the occiput a horn-like, compressed process, broad at the base, somewhat attenuated, but truncated at the apex. It is arched, placed horizontally, with the apex bent downwards. On the upper margin, close to the apex appear four minute spines. The two first dorsal spiny processes immediately behind the horn-like one, are very minute, triangular, with the point directed backwards; the third is truncated with a minute spine in front and behind; the fourth is much larger and consists of a forwards directed spine; the succeeding four spines gradually increase and are all directed backwards. The dorsal fin is preceded by two spines of which the anterior is  $\frac{1}{2}$  of the second, which again is  $\frac{1}{2}$  of the length of the first ray. The greatest vertical diameter of the body, in front of the first dorsal ray, is  $\frac{1}{2}$  of the total length. Each of the broad, excavated ribs, from the third to the fifteenth vertebra, serves to form a conical, funnel-shaped cavity, very pointed towards the tail. The broad truncated lower extremity of each rib is striated, so as to appear as if fringed. The stomach is a rounded, rather capacious sac, generally expanded by remains of *Crustacea*; the liver is small, divided in two lobes; the gall bladder and the spleen excessively minute. The narrow intestinal canal forms two circumvolutions: its length is about  $\frac{2}{3}$  of the length of the fish. In the Straits of Malacca and the Bay of Bengal as far as the mouths of the Ganges, it is excessively numerous at all seasons. Individuals with the horn-like process are far less numerous than those without it. Large quantities are dried, and consumed by the natives of India. Plate 277 of Cuvier and Valenciennes represents the fish much too red.

GEN. EQUULA, Cuvier 1817.

Body compressed; dorsal undivided; snout greatly protractile; edges of back and abdomen dentated along the fins.

EQUULA CABALLA, Cuv. and Val.

*Scomber equula*, Forskål, Faun. Arab, 58, No. 77.

*Centrogaster equula*, Linné: Syst. 1337.

*Cæcio poulain*, Lacép. III. 90.

Russell LXII. Tottah Karah?

*Scomber equula*, Shaw, IV. 596.

*Equula caballa*, Cuv. and Val. X. 73.

*Equula caballa*, Rüppell: Neue Wirbelth. Fische, 51.

*Equula caballa*, Bleeker: Verh. Bat. Gen. XXII. 5.

Head above and back silvery pale green, minutely dotted with black; the rest of the head and body shining silvery; muzzle above greenish grey, minutely dotted with black; dorsal and anal spines pale silvery iridescent, and as well as their membranes sparingly dotted with black; the base of the dorsal and anal membrane pale reddish yellow, the rest hyaline, the margin of the dorsal blackish; caudal yellowish white, minutely dotted with black, so as to render the posterior margin blackish; ventrals white, reddish yellow at the base and with a few black dots; pectorals hyaline, blackish silvery outside along the root, on the innerside and in axilla black. Iris silvery, orbital half blackish.

D 8/16 or 7/17, C 17 $\frac{1}{2}$ , A 3/14 or 15, V 1/5, P 18 or 19, Br. V.

HABIT.—*Sea of Pinang, Singapore.*

Red Sea, Bombay, Malabar, Guam, Coromandel, Java,  
Sumbawa, Madura.

TOTAL LENGTH: 6 inch.

The length of the head is  $3\frac{1}{2}$  in the total, to the centre of the caudal margin; but with the muzzle protracted it slightly exceeds  $\frac{1}{2}$  of the total. The diameter of the eye is  $\frac{1}{2}$  of the length of the head. The narrow band of fine flexible teeth in the jaws, is almost hid by the fleshy lips. The lower part of the protracted muzzle is considerably arched downwards. The greatest vertical diameter of the body, in front of the dorsal fin, is  $\frac{1}{2}$  of the total length. The second dorsal spine is broad, sabre-like, with a sharp edge, and on each side with a narrow longitudinal furrow. The second anal is shorter, but of the same shape. The anterior margin of the third and fourth dorsal, and of the third anal spine is toothed like a saw. Both the dorsal, anal, and ventral spines have the posterior margin transversely striated, a structure also observed in some species of the Genera *Apogon*, Lacép. and *Chanda*, Buchan, Ham. The succeeding species of *Equula* present the same structure of these organs. The length of the second dorsal spine equals that of the head, or  $\frac{1}{2}$  of the greatest vertical diameter of the body; the third dorsal is  $\frac{1}{2}$  shorter than the second. The second anal spine is even broader than the second dorsal.

but shorter, its length but slightly exceeding that of the third dorsal. The third anal is  $\frac{1}{2}$  of the second. In *Equula edentula* (Bloch) (Syn. *Scomber edentulus*, Bloch.—*E. ensifera*, Cuv. and Val.) the two spines are of nearly equal length. At Pinang single individuals are of rare occurrence.

#### EQUULA BINDUS, Cuv. and Val.

Russell LXIV. Bindoo Karah.

*Equula bindus*, Cuv. and Val. X. 78.

*Young.* Head above and back silvery pale green, minutely dotted with black, so as to form a blackish line along the base of the dorsal; rest of the body shining silvery; upper part of opercle steel blue; dorsal fin hyaline, edged with black, upper third of the second, third, fourth and fifth dorsal spines bright orange; caudal pale yellowish minutely dotted with black, posterior margin blackish; anterior third of anal bright yellow, the rest hyaline; ventrals and pectorals whitish; inside of the mouth and gill-covers dotted with black. Iris silvery, orbital half blackish.

D 8/16, C 17 $\frac{1}{2}$ , A 3/14, V 1/5, P 15, Br. V.

HABIT.—*Sea of Pinang.*

Coromandel.

TOTAL LENGTH: 3 inch.

The length of the head is  $3\frac{1}{2}$  in the total to the centre of the caudal margin; when the muzzle is protracted, it is  $\frac{1}{2}$ . The latter projects horizontally, forming a short truncated cone. In both jaws appear a single series of excessively fine setaceous teeth. The diameter of the eye is  $\frac{1}{2}$  of the length of the head. The two small spines above the anterior part of each orbit are strongly marked. The upper margin of the orbit is very finely toothed, but all the cranial crests are smooth. Russell's remark, that the back before the dorsal fin feels serrated to the finger, must therefore refer to the upper margin of the orbit. Between the interparietal crest and the first dorsal spine appears a smaller interspinal crest, the apex of which, however, does not in this more than in the other species penetrate the integuments. The greatest vertical diameter of the body, in front of the dorsal fin, is  $\frac{1}{2}$  of the total length. The second dorsal spine is  $\frac{1}{2}$  of the latter, or  $\frac{1}{2}$  of the greatest vertical diameter; the third dorsal spine is but little



shorter. The second anal spine equals in length the second dorsal, but it is a little less broad; the third anal is  $\frac{2}{3}$  of the second. The ventral fins are remarkably short; their length equals the diameter of the eye; their spine is distinct, but slender. A single individual was observed at Pinang in April 1844.

*EQUULA SPLENDENS*, Cuvier.

Russell LXI. Goomorah Karah.

*Equula splendens*, Cuvier R. A. II. 212 (?).

*Equula gomorah*, Cuv. and Val. X. 80.

*Equula gomora*, Rüppell, Neue Wirb. Fische, 51.

Head above and back pale golden green, minutely dotted with black, forming a blackish line along the base of the dorsal fin; rest of the body silvery satin; the muzzle minutely dotted with black; a little above the lateral line an arched pale reddish line joining the posterior third of the lateral, which itself above borders a broad longitudinal pale reddish band; cheeks and opercles shining silvery; membrane of dorsal hyaline, the upper half between the second and sixth spine black; the rest edged with black; caudal pale reddish yellow, minutely dotted with black; anal pale reddish yellow; ventrals and pectorals white. Iris silvery, orbital margin black.

D 8/16, C 17 $\frac{1}{2}$ , A 3/14, V 1/5, P 19, Br. V.

HABIT.—*Sea of Pinang.*

Coromandel, Malabar, Red Sea.

TOTAL LENGTH: 4 inch.

The length of the head is  $3\frac{1}{2}$  in the total to the centre of the caudal margin; with the muzzle protracted, it is  $3\frac{1}{2}$ . The latter projects very slightly downwards, forming a short truncated cone. The lips are rather fleshy and hide the single series of fine setaceous teeth. The diameter of the eye is a little more than  $\frac{1}{2}$  of the length of the head. The greatest vertical diameter of the body, in front of the dorsal, is  $2\frac{1}{2}$  in the total length. The second dorsal spine is  $\frac{1}{2}$  of the total length, a little less than  $\frac{1}{2}$  of the greatest vertical diameter; the third dorsal is but little shorter. The second anal spine is  $\frac{2}{3}$  of the second dorsal; the third anal slightly shorter than the second. Single individuals occur, but rarely, at Pinang.

**EQUULA DAURA, Cuvier.**

Russell LXV. Dacer Karah.

*Equula daura*, Cuvier R. A. II. 212, (?).

*Equula dacer*, Cuv. and Val. X. 83.

*Young.* Head above and back light greenish grey, minutely dotted with black, forming a black line along the base of the dorsal; rest of the body silvery satin; between the occiput and dorsal fin a large triangular blackish spot, not descending to the lateral line; from the posterior angle of the opercle to the caudal a pale yellowish longitudinal band; cheeks and opercles shining silvery, infraorbitals blackish; dorsal hyaline, upper half between the second and sixth spine blackish; caudal yellowish white, minutely dotted with black; anal and pectorals hyaline; ventrals white. Iris silvery, orbital half black.

D 8/16, C 17 $\frac{1}{2}$ , A 3/15, V 1/5, P 19, Br. V.

**HABIT.**—*Sea of Pinang.*

Coromandel, Ceylon.

**TOTAL LENGTH:** 2 $\frac{3}{4}$  inch.

The length of the head is 3 $\frac{1}{4}$  in the total to the centre of the caudal margin; when the conical, slightly downwards arched muzzle is protracted, it is 3 $\frac{1}{2}$ . The diameter of the eye is  $\frac{1}{3}$  of the length of the head. The greatest vertical diameter of the body is little less than  $\frac{1}{2}$  of the total length. The second dorsal spine is 4 $\frac{1}{2}$  in the total length; the third is but little shorter; the second anal is  $\frac{2}{3}$  of the second dorsal; the third anal is  $\frac{1}{2}$  of the second. Single individuals occur occasionally at Pinang.

**EQUULA FILIGERA, Cuv. and Val.**

Cuvier: Mem. du Mus. I. 402, Pl. 23, Fig. 1.

*Equula filigera*, Cuv. and Val. X. 92, Pl. 284.

*Equula filigera*, Swainson II. 250.

Head above and back pale greyish green, minutely dotted with brown; rest of the head and body shining silvery; fins yellowish white; dorsal spines and their membranes, and the muzzle dotted with pale brown. Iris silvery, orbital margin blackish.

D 8/16, C 17 $\frac{1}{2}$ , A 3/14, V 1/5, P 19, Br. V.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Singapore.*

Moluccas, Seychelles, Malabar, Ceylon.

**TOTAL LENGTH:** 5 inch.

The length of the head is  $3\frac{1}{2}$  in the total to the centre of the caudal margin; with the protracted downwards arched muzzle it is  $\frac{1}{2}$ . The diameter of the eye is  $3\frac{1}{2}$  in the length of the head. The fleshy lips entirely cover the narrow bands of setaceous teeth. The greatest vertical diameter, in front of the dorsal fin, slightly exceeds  $\frac{1}{2}$  of the total length. The second, slender, flexible dorsal spine is by  $\frac{1}{2}$  less than the greatest vertical diameter of the body; the third is about  $\frac{1}{2}$  of the length of the second anal; it slightly exceeds  $\frac{1}{2}$  of the second dorsal, and is of equal breadth; the third anal is  $\frac{2}{3}$  of the second. This species occurs, but not numerous, at all seasons at Pinang.

*EQUULA INSIDIATRIX*, (Bloch).

*Zeus insidiator*, Bloch, Pl. 192, Fig. 2.

*Zeus insidiator*, Linné, Syst. 1221.

*Zée rusé*, Lacép. IV. 575.

*Zeus insidiator*, Shaw IV. 284. Pl. 41.

*Equula insidiatrix*, Cuv. R. A. II. 212 (?).

*Equula insidiatrix*, Cuv. and Val. X. 98.

*Equula insidiatrix*, Bleeker: Verh. Bat. Gen. XXII. 5.

Head above and back metallic violet, paler on the sides towards the lateral line; rest of the head and body shining silvery; head and back minutely dotted with black, forming a blackish line along the base of the dorsal; along the upper part of the sides nine or ten pale reddish brown vertical bands, each consisting of three or four round or irregular spots, descending a little beneath the lateral line; in some individuals a blackish spot on the upper part of the opercle; from the lower part of the orbit along the anterior margin of the cheek an oblique black line, bordered behind by a sulphur-coloured one; fins hyaline; caudal minutely dotted, dorsal edged with black; cavity of the mouth minutely dotted with black; internal surface of opercles sulphur-coloured, partially dotted with black. Iris silvery, orbital margin black.

D 8/16, C 17 $\frac{2}{3}$ , A 3/14, V 1/5., Br. IV?

**HABIT.**—*Sea of Malayan Peninsula and Islands.*

Surat, Coromandel, Malabar, Bay of Bengal, Mouths of the Ganges, Java, Madura.

**TOTAL LENGTH:**  $3\frac{1}{2}$  inch.

The length of the head is  $\frac{1}{2}$  of the total to the centre of the poste-

rior margin of the caudal; when the slightly upwards directed tubular mouth is protracted, it is  $\frac{1}{2}$  of the total. The lower margin of the preopercle, particularly the anterior part, is finely yet distinctly toothed. The diameter of the eye is  $2\frac{1}{2}$  in the length of the head. The greatest vertical diameter of the body, in front of the dorsal, is a little less than  $\frac{1}{2}$  of the total length. The second dorsal spine is  $\frac{1}{2}$  of the greatest vertical diameter of the body. The second anal spine is  $\frac{2}{3}$  of the second dorsal; the third anal is  $\frac{1}{2}$  of the second, but much slenderer. The ventrals are very short, their length somewhat less than the diameter of the eye. The branchiostegous membrane appears to have a fifth excessively minute ray. This species is at all seasons very abundant in the Straits of Malacca, and numbers are dried and consumed by the natives.

*EQUULA LONGIMANA*, Cantor.

Head above and back lead coloured, minutely dotted with black along the dorsal fin; rest of the head and body shining silvery, slightly iridescent; where the opercle and preopercle join above appears a pale blackish spot; on the anterior part of the side between the commencement of the dorsal and the anterior third of the pectoral, a large rounded bluish black spot; fins hyaline; upper half of dorsal membrane, between the third and eighth spine, indistinctly spotted with pale brown. Iris silvery, orbital half black.

D 10/15, C 17 $\frac{1}{2}$ , A 4/13, V 1/5, P 13, Br. V.

HABIT.—*Sea of Malayan Peninsula and Islands.*

TOTAL LENGTH: 4 $\frac{1}{2}$  inch.

The general form of the fish is elongated oblong, the greatest vertical diameter of the body, in front of the dorsal fin, being  $\frac{1}{2}$  of the total length, measured to the centre of the posterior margin of the caudal. The length of the head is  $3\frac{1}{2}$  in that distance; when the very little downwards protractile mouth is extended, it is  $\frac{1}{2}$ . The cranial crests are short and less sharp than in the preceding species. No spines appear above the anterior part of the orbit. The diameter of the eye is  $2\frac{1}{2}$  in the length of the head. The lips are fleshy, covering a narrow band of minute, recurvous, setaceous teeth, of which there are fewer in the lower than in the upper jaw. The opercle terminates behind in a very obtuse, membranous angle; it is joined to the subopercle by an oblique line; by a vertical to the preopercle. The latter

is triangular, with the posterior part very thin; the posterior margin is smooth, not toothed, its ascending portion is vertical, the lower rounded, nearly horizontal; the anterior margin is thick, forming a broad, oblique line. The interopercle fits closely so as to cover the branchiostegous membrane; its lower margin is convex. The infraorbitals are completely hid. The cheeks, as well as the rest of the head are covered with scales like those of the body, but the opercles have a scaleless appearance. The indistinct lateral line follows the outline of the back along the upper third of the body. It appears during life to be naked; it is, however, covered with large rounded, diaphanous scales. They are deciduous, and the vertical diameter of the part exposed exceeds three to four times the horizontal. All the spines of the fins are finely transversely striated, but not toothed, and, except the second anal, remarkably slender, transparent. The first dorsal spine is excessively minute; the second is  $\frac{1}{3}$  of the third, the length of which slightly exceeds  $\frac{1}{2}$  of the greatest vertical diameter of the body; the fourth and fifth are but little shorter. The second anal spine is  $\frac{2}{3}$  of the second dorsal, but much broader, sabre-like; the third anal is  $\frac{2}{3}$  of the second. The pectorals differ from those of all the other species by being very elongated and falcated; they extend as far back as the posterior third of the dorsal fin; their length is  $\frac{1}{3}$  of the total. The ventrals are less than  $\frac{1}{2}$  of the pectorals. The caudal lobes equal the length of the head. The series of spines along the base of the dorsal and anal fin are very small. In the Straits of Malacca this species is very abundant at all seasons, and quantities, both fresh and dried, are consumed by the natives.

GEN. GAZZA, *Rüppell* 1835.

Body compressed, with very minute scales; mouth moderate, greatly protractile, with a single series of crooked teeth among which a few longer and stronger than the rest; no teeth on the palatals nor vomer; preopercle with a double margin; the lower part of the external margin serrated; otherwise resembling *Equula*, but the series of spines along the base of the dorsal and anal fins may be felt, not seen.

GAZZA EQUULAEFORMIS, *Rüppell*.

Gazza equulaeformis, *Rüppell*: Neue Wirbelth. Fische, 4, Tab. 1,  
Fig. 3.

Head above and back pale lead coloured, minutely dotted with black;

rest of head and body shining silvery ; muzzle and upper lip minutely dotted with black, the cheeks with pale blue ; palate, floor of the mouth and internal surface of branchiostegous membrane minutely dotted with black ; dorsal and anal spines pale steel blue ; fin-membranes hyaline ; dorsal between the second and sixth spine minutely dotted with black, superior margin black ; posterior half of caudal minutely dotted with black. Iris silvery, orbital margin black.

D 8/16, C 17½, A 3/14, V 1/5, P 16 or 17, Br. V.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Massaua (Red Sea.)

TOTAL LENGTH : 4 inch.

The length of the head is  $3\frac{1}{2}$  in the total to the centre of the posterior margin of the caudal ; with the mouth protracted it is  $\frac{1}{2}$ . The diameter of the eye is  $\frac{1}{2}$  of the length of the head. Above the anterior part of the orbit appear two minute spines, and behind them the whole of the upper margin of the orbit is very finely toothed. The greatest vertical diameter of the body, in front of the dorsal fin, slightly exceeds  $2\frac{1}{2}$  in the total length. The second dorsal spine is  $2\frac{1}{2}$  in the greatest vertical diameter ; the second anal is  $\frac{3}{4}$  of the length of the second dorsal ; third anal is but slightly shorter than the second. The superior branchiostegous ray is closely adhering to the gill-cover ; the inferior, (the fifth,) is farther removed from the fourth than the other four are among themselves. In the Straits of Malacca this species is very numerous at all seasons, and forms like the rest an article of food.

GEN. MENE, *Lacépède* 1803.

Mouth like that of *Equula*, but body more compressed ; margin of abdomen trenchant, very convex owing to the development of the scapular and pelvic bones, throwing the ventrals farther back than the pectorals ; profile of the back nearly horizontal.

MENE MACULATA, (Bloch-Schneider.)

*Zeus maculatus*, Bloch-Schneider, 479, 480, Pl. 14, Fig. 2.

*Mene anne-caroline*, Lacép. V. 95, No. 6, Pl. 22.

Russell LX. *Ambata* Kuttee.

*Mene maculata*, Cuv. and Val. X. 104, Pl. 285.

*Mene maculata*, Swainson II. 251.

*Mene maculata*, Temm. Schl. Fauna Japon. Pisc. 127, Pl. LXVII

Fig. 3.

*Mene maculata*, Richardson, Report 1845, 276.

Head above and back greenish lead coloured, paler on the sides towards the lateral line; rest of the body silvery satin; above the lateral line one or two longitudinal series of more or less distinct, rounded, lead coloured spots; beneath the lateral line two similar series; jaws, cheeks and opercles shining silvery; dorsal pale olive greyish, minutely dotted with black; caudal silvery at the base, rest yellowish white, minutely dotted with black; anal silvery white; ventrals white; first, elongated ray, silvery at the base, rest blackish; pectorals hyaline; lips blackish; tongue, and internal surface of the mouth dotted with black. Iris silvery, orbital margin blackish.

D 4/43, C 17½, A 31, V 1½, P 16, Br. VII.

HABIT.—*Sea of Pinang.*

Java, Coromandel, Japan.

TOTAL LENGTH: 5 inch.

The length of the head is  $3\frac{1}{4}$  in the total to the centre of the posterior margin of the caudal, with the muzzle protracted it is  $2\frac{1}{4}$ . The diameter of the eye is  $3\frac{1}{4}$  in the length of the head. The teeth are excessively minute, velvety: in the upper jaw their narrow linear band suddenly widens towards the angle of the mouth. In the space between the interparietal and the interspinal crest, in front of the dorsal fin, appear in succession three small flattened, lancet-shaped ossicles. The greatest vertical diameter of the body, in front of the dorsal fin, is a little less than  $\frac{2}{3}$  of the total length. In a solitary individual, observed in August 1845 at Pinang, the lateral line presents the following appearance. The short anterior part, consisting of three rather large tubes, rises nearly vertically, when it turns backwards under a nearly right angle, and proceeds very close to the back towards the origin of the dorsal, where it suddenly disappears. A similar line, but formed of much smaller tubes, commences on the upper fifth of the back, opposite the eighth dorsal ray, and proceeds, deviating a little obliquely upwards, to the thirty-first dorsal ray, where it suddenly terminates. The length of the first ventral ray is  $2\frac{1}{4}$  in the total length. The pectoral rays are remarkably broad, compressed, particularly the second which resembles the blade of a sabre.

## FAM. CHÆTODONTIDÆ.

GEN. CHÆTODON, (*Artedi*) Linné 1748.

Teeth of the jaws slender, flexible and close like the hairs of a brush; mouth very small, slightly or not at all projecting; body elliptical or nearly orbicular; caudal fin truncated; 12 or 13 dorsal, 3 anal spines; dorsal spines and rays continued in a nearly uniform curve; branchiostegous rays six.

CHÆTODON PRÆTEXTATUS, Cantor.

Plate III.

Head as far as the occiput, gill-covers and throat black; on the chin a rounded white spot; a white band round the throat to the angle of the mouth; a second, also encircling the throat, obliquely upwards and forwards in front of the eye across the forehead; a third, narrow, backwards arched white line on the forehead between the eyes; a broad white band surrounding the chest, narrowing as it vertically ascends between the preopercle and the eye, and continues a little in front of the first dorsal spine; body and the scaly part of the dorsal and anal fin light greyish brown; each scale minutely dotted with black, and on the body with a short central dark bar, reflecting a series of parallel lines ascending obliquely backwards; dorsal spines vermilion, their membrane light greyish brown; margin of the soft fin black (the very point of the rays colourless,) beneath bordered by a narrow white line, under which a broad vermilion band, gradually widening backwards; in some the latter is placed immediately under the black margin, and longitudinally divided by a narrow white line; on the anterior half of the caudal a vertical vermilion band, next a narrower black, behind which the rest of the fin is white; anal spines light brownish grey, membrane black; margin of the soft part black (the very point of the rays colourless,) bordered above by a broad crescent-shaped vermilion band; ventrals black; pectorals brownish or blackish at the root; the rays brownish white, membrane transparent. Iris milky white or buff.

D 12/26, 27 or 28, C 17½, A 3/20, 21 or 22, V 1/5, P 15 or 16,

Br. VI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 5½ inch.



The outline of the much compressed body is broad oval, deeply emarginated behind by the three vertical fins; the profile descends nearly straight from the dorsal fin to the narrow, slightly elongated muzzle. The greatest vertical diameter of the body, taken from the root of the 7th dorsal spine, is  $\frac{1}{2}$  of the total length. The length of the head, nearly equalling the height at the occiput, is about  $\frac{1}{2}$  of the total length; the eye is situated a little above the centre of the longitudinal diameter, but in the centre of the greatest vertical diameter of the head; its diameter is  $\frac{1}{3}$  of the length of the head. The mouth is slightly protractile, very small, the cleft being  $\frac{1}{4}$  of the length of the head; the teeth are normal; the nostrils open near the anterior part of the orbit; the preopercle is narrow; near the angle are a few indistinct crenulations; the opercle terminates in a small flat membranous point. The black ocular band is in front bordered by the second white band, which obliquely encircles that part of the head; behind by the posterior white band, which from the chest proceeds vertically over the preopercle to a little in front of the anterior dorsal spine. As the profile of the head is sloping, the black ocular band is nearly threesided, much broader above than below the eye. The dorsal spines gradually increase in length till the fifth which, as well as the rest, is nearly equal  $\frac{2}{3}$  of the length of the head; the two anterior spines are exposed; the rest become gradually covered with scales which spread in an oblique arched line, so as barely to leave the points of the three last spines visible; the soft portion is gently arched, scaly, highest in the middle, where the rays slightly exceed the length of the fifth spine. The length of the caudal fin is a little more than  $\frac{1}{2}$  of the length of the head; the posterior margin is straight when at rest, but rounded when expanded, and then more than double the length of the fin; the anterior  $\frac{2}{3}$  are covered with scales. The anal commences opposite the 8th or 9th dorsal ray; the anterior spine is  $\frac{2}{3}$  of the second and third, which in length equal the fifth dorsal; they are gradually covered with scales, so that of the last one third only is exposed; the soft part is rounded, scaly, its highest elevation in the middle equalling that of the dorsal. The ventrals commence opposite the termination of the root of the pectorals; the length of the spine is  $\frac{1}{2}$  of that of the head, and  $\frac{2}{3}$  of that of the first ray; above the root of each ventral appears a broad pointed scale. The length of the pectorals is a little more than

$\frac{1}{2}$  of the total. The scales of the body are rounded, higher than long, ciliated; those of the lateral line much smaller than the rest and nearly triangular; the line itself ascends backwards till opposite the 11th dorsal spine, from whence it descends, closely following the back to the termination of the soft dorsal fin. The lateral line follows a similar course in *Chaetodon reticulatus*, Cuv. and Val. Of the present species two were observed at Pinang in May 1845, and in June eleven were taken together in a fishing net, all nearly of equal size. The fishermen asserted the fish to be an excellent article of food, but of rare occurrence, and not to attain greater dimensions. Like other species of this and the neighbouring genera, the present expires immediately, when removed from its element. It appears to be allied to *C. reticulatus* and *C. lunula*, Cuv. and Val.

GEN. CHELMON, Cuvier 1817.

Muzzle excessively long, slender, formed by the horizontally elongated intermaxillary bone and the lower jaw, both of which have one half or two thirds united by a membrane, so as to reduce the mouth to a small horizontal cleft at the extremity of the cylinder; teeth in both jaws fine, velvety; in other respects like *Chaetodon*.

#### CHELMON ROSTRATUS, (Linné.)

Seba. III. Pl. 25, Fig. 17.

*Chaetodon rostratus*, Lin. Mus. Ad. Fr. I. 61, Tab. 33, Fig. 2.

*Chaetodon rostratus*, Linné, Syst. 1244.

*Jaculator*, Schlosser: Phil. Transact, 1764, 39, Pl. 9.

*Chaetodon rostratus*, Bloch. Pl. 102, Fig. 1.

*Chaetodon enceladus*, Shaw: Nat. Misc. 2, Pl. 67.

*Chaetodon rostratus*, Shaw IV. 337, Pl. 47.

*Chelmon rostratus*, Cuv. R. A. II. 190.

*Chelmon rostratus*, Bennett: Life of Raffles, 689.

*Chelmon rostratus*, Cuv. and Val. VII. 87.

Ground colour of body and fins silvery, with one frontal and five vertical, lateral bands; all, except the fifth, orange or brownish ochreous, edged with blackish brown, outside of which with white; the frontal band along the profile of the head to the point of the elongated muzzle; the first lateral from the occiput through the iris to the throat; the second from between the first and second dorsal spine over the opercle

in front of the pectoral to the abdomen in front of the ventrals; the third from the sixth and seventh dorsal spine down to the anus; the fourth, the broadest, from between the ninth spine and the tenth dorsal ray to between the third anal; within this band, at the base of the soft dorsal, a rounded black spot edged with white; the fifth, in front of the caudal, black with white margins. The soft dorsal and anal with a black margin, the base of which bordered by a white line enclosed between two black ones; the anterior half of the caudal pale ochreous, the rest as well as the pectorals and ventrals white, the latter minutely dotted with black. Iris pale golden orange, longitudinally divided by the ocular band.

D 9/29, C  $17\frac{3}{4}$ , A  $3/20$ , V  $1/5$ , P'15, Br. V.

HABIT.—*Sea of Singapore, Malacca.*

Sea and rivers of Java, Sumatra.

TOTAL LENGTH:  $5\frac{1}{4}$  inch.

Numbers were observed in May 1840, at Singapore; they were, however, all dead, and their colours apparently somewhat faded. The fish is considered excellent by the natives, and eaten both fresh and dried. At Malacca it appears to be of rare occurrence, and at Pinang no specimen was observed during upwards of four years search. The fishermen judging from a drawing, asserted that they were acquainted with the species, but they invariably brought *Platax ocellatus*, Cuv. and Val. instead, which in colours and their peculiar distribution, certainly offers a remarkable resemblance to the present species.

GEN. DIPHREUTES,\* *Cantor.*

(*Equivalent to HENIOCHUS, Cuvier.*)

The anterior dorsal spines rapidly increasing in length, the third or fourth filamentous, sometimes double the length of the body, resembling a coach-whip; scales large.

DIPHREUTES MACROLEPIDOTUS, (Linné.)

*Chaetodon macrolepidotus*, Linné, Syst. 1247.

*Chaetodon macrolepidotus*, Bloch, Pl. 200, Fig. 1.

*Chaetodon bifasciatus*, Shaw IV. 342.

*Heniochus macrolepidotus*, Cuv. R. A. II. 191. (')

*Heniochus macrolepidotus*, Cuv. and Val. VII. 93, Pl. 176.

\* *Διφρευτής*, a charioteer. Substituted for *Heniochus*, Cuvier 1817, pre-occupied by *Henioche*, Hübner 1816. (*Lepidoptera.*)

*Heniochus macrolepidotus*, Temm. and Schl. F. J. Pisc. 82, Tab. XLIV. Fig. 1. (*Young*.)

*Heniochus macrolepidotus*, Richardson, Report 1845, 246.

*Young*. Ground colour of the head and body milk-white; on the upper part of the muzzle, as far as the anterior opening of the nostrils, a small black rectangular band; between the eyes across the forehead, a backwards pointing angular black band; a broader, comprising the three anterior and in some the root of the elongated fourth dorsal spine, proceeds obliquely downwards over the side and posterior part of the opercle, from whence it becomes broader, spreading in front over the ventrals, behind over the spinous part of the anal, edging the soft part; a posterior black band, partially covering the 5th, 6th, 7th and 8th dorsal spine, proceeds obliquely backwards over the side covering the posterior half of the soft anal. The fourth elongated, flexible, dorsal spine and its membrane milk-white, minutely dotted with black; rest of the dorsal, the caudal and pectoral fins bright gamboge or citrine. Iris gamboge, blackish towards the orbit, divided by an oblique black band, appearing as a continuation of the angular one of the forehead.

D 11/25 or 26, C 17½, A 3/18 or 19, V 1/5, P 17, Br. V.

HABIT.—*Sea of Pinang, Singapore, Malayan Peninsula.*

Manilla, Moluccas, New Guinea, Celebes, Ceylon, Pondicherry, Isle of France, Mauritius, Mozambique, Japan.

TOTAL LENGTH: 6 inch.

Solitary young individuals, not exceeding the length given, occur at all seasons at Pinang.

GEN. ILARCHES,\* *Cantor*.

(*Equivalent to EPHIPPUS, Cuvier*.)

Body oval or nearly orbicular; dorsal fins two, or one deeply emarginated between the spinous and soft portion; the former not covered with scales, capable of reclining in a groove, formed by the skin of the back; anal spines three; pectorals oval.

ILARCHES ORBIS, (Bloch).

*Chætodon orbis*, Bloch, Tab. 202, Fig. 2.

*Chætodon orbis*, Linné, Syst. 1244.

\* Ιλάρχης, commander of a troop. Substituted for *Ephippus*, Cuvier 1829, pre-occupied by *Ephippium*, Latreille 1802 (*Diptera*.)

*Chaetodon orbe*, Lacép. IV. 458, 491.

*Chaetodon orbis*, Shaw, IV. 339.

*Ephippus orbis*, Cuv. R. A. II. 191 (\*).

*Ephippus orbis*, Cuvier and Val. VII. 127.

*Ephippus orbis*, Swainson, II. 213.

*Ephippus orbis*, Richardson Rep. 1845, 245.

Head above and back light greyish green; sides and abdomen silvery with pale lilac lustre; fin-membranes transparent, minutely dotted with black, giving the marginal half a blackish appearance; dorsal and anal spines and their membranes, pale silvery, the rays yellowish white. Iris pale golden, minutely dotted with black.

D 8—1/19, C 17½, A 3/16, V 1/5, P 19, Br. VI.

HABIT.—*Sea of Pinang, Singapore, Malayan Peninsula.*

Malabar, Tranquebar, Pondicherry, Indian and China Seas.

Total length: 5½ inch.

The greatest vertical diameter of the head exceeds by  $\frac{1}{2}$  its length, which is a little less than  $\frac{1}{4}$  of the total; the greatest vertical diameter of the body is  $1\frac{1}{2}$  in the total length. The young individuals, like those of *Ilarches faber*, (Brouss.) are of a less orbicular outline than the adult, their greatest vertical diameter being  $\frac{1}{2}$  of the total length. On each side of the centre of the upper jaw appears a small pore, and on each side of the symphysis of the lower two similar, the one placed a little in front of the other. There is besides a larger pore or sometimes two on each branch of the lower jaw. The posterior margin of the caudal fin is not straight, but convex in the centre, above and below which it is slightly concave. In the young the colour of the dorsal membrane, particularly the upper half of the soft, the anal and the ventral is of a deeper black than in the adult. Although individuals occur at Pinang at all seasons, they are not numerous. The fish though bony, and considered indifferent, is by the natives consumed both fresh and dried.

GEN. HARPOCHIRUS,\* *Cantor.*

(Equivalent to *DREPANE*, Cuv. and Val.)

Pectoral fins elongated, falciform, nearly reaching the base of the caudal; outline of the body almost quadrangular.

\* *Ἀπρη*, scythe; *χείρ*, hand. Substituted for *Drepans*, Cuv. and Val. 1831, pre-occupied by *Drepans*, Schrank 1802 (*Lepidoptera*.)

**HARPOCHIRUS PUNCTATUS, (Linné).**

*Chaetodon punctatus*, Linné: Syst. 1243.

*Chétodon faucheur*, Lacépède.

*Chaetodon punctatus*, Shaw, IV. 365.

Russell LXXIX. Latte.

*Ehippus punctatus*, Cuv. R. A. II. 191 (\*).

*Drepane punctata*, Cuv. and Val. VII. 132, Pl. 179.

*Drepane punctata*, Swainson II. 213.

*Drepane punctata*, Richardson, Report 1845, 245.

*Drepane punctata*, Bleeker: Verh. Bat. Gen. XXII. 5.

Head and body iridescent silvery; the crest from the occiput to the dorsal fin blackish; the upper half of the sides with more or less regular vertical series of small black spots; in some a small black spot in the axilla, in others a single oblique series of spots at the base of the soft dorsal; spines and rays pale silvery, the anterior margins of the first dorsal ray black; fin-membranes whitish transparent, the scaly portion silvery, the marginal minutely dotted with black, in some sufficiently strong to impart a blackish appearance to the marginal half. Iris silvery.

D 8—1/20 or 21, C 17½, A 3/17, V 1/5, P 17 or 18, Br. VI.

**HABIT.**—*Sea and estuaries Pinang, Malayan Peninsula, Singapore, Coasts of New Holland, New Guinea, Southern coasts of China, Java, Celebes, Madura, Bay of Bengal, Gangetic estuaries, Malabar.*

**TOTAL LENGTH:** 1 foot 5 inch.

The body appears to become elongated with age: in the adult the diameter from the angle of the back to that at the commencement of the anal fin is about  $\frac{1}{4}$  of the length of the body, the caudal not included. In the young it is something more than  $\frac{1}{4}$  of that distance. In the very young individuals the occipital crest is denticulated, and they are at all seasons numerous at Pinang, but large individuals occur rarely. In the largest observed, the length of which is given above, the rounded protuberance of the skull between the eyes is very large and prominent, and the roots of the four central caudal rays are enlarged and joined together without any intermediate membrane. A similar enlargement of the occipital crest and some of the bones occurs in adult individuals of *Platan arthriticus*, Cuv. and Val. The present species

is bony and insipid. It is, however, eaten by the natives in its fresh and dried state.

**HARPOCHIRUS LONGIMANUS, (Bloch-Schneider.)**

*Chaetodon longimanus*, Bloch-Schneider, 231.

Russell LXXX. Terla A.

Russell LXXXI. Terla B.

*Ehippus longimanus*, Cuv. R. A. II. 191 (\*).

*Drepane longimana*, Cuv. and Val. VII. 133.

*Drepane longimana*, Richardson Report 1845, 245.

*Young*.—Head and body iridescent silvery; the crest from the occiput to the dorsal fin blackish; the upper half of the sides with four or five vertical, more or less distinct, lead coloured bands. Fins like *H. punctatus*. Iris silvery.

*Adult*.—Body uniformly iridescent silvery; rest like the young. Number of fin rays like *H. punctatus*.

**HABIT**.—*Sea and estuaries of Pinang, Malayan Peninsula, Singapore.*

Java, Bay of Bengal, Gangetic estuaries, Malabar, China Seas.

**TOTAL LENGTH** : 8½ inch.

Except the colours, no external character can be assigned to distinguish the two species, but anatomical differences have been pointed out by M. M. Cuvier and Valenciennes. Large individuals are rarely seen at Pinang, but there, as in the mouths of the Ganges, young ones are very numerous. During life or shortly after death, none of those examined presented the red colour described by Russell.

**GEN. CACODOXUS,\* Cantor.**

(*Equivalent to SCATOPHAGUS, Cuvier and Valenciennes.*)

Four anal, eleven dorsal spines; scales excessively small.

**CACODOXUS ARGUS, (Linné.)**

*Chaetodon argus*, Linné, Syst. 1248.

*Chaetodon argus*, Bloch, Tab. 204, Fig. 1.

*Chaetodon argus*, Shaw, IV. 332.

Russell LXXVIII. Chitsilloo.

*Chaetodon pairatalis*, Buchan. Hamilton, 122, 372, Pl. 16, Fig. 41.

\* *Käckodoços*, ill-reputed. Substituted for *Scatophagus*, Cuv. and Val. 1831, pre-occupied by *Scatophaga*, Meigen 1802. (*Diptera.*)

*Ephippus argus*, Cuv. R. A. II. 191.

*Chaetodon atromaculatus*, Bennett : Ceylon No. 18.

*Scatophagus argus*, Cuv. and Val. VII. 136.

*Scatophagus argus*, Richardson Report 1845, 245.

*Scatophagus argus*, Bleeker : Verh. Bat. Gen. XXII. 5.

Head above and back silvery blackish or brownish green, or purple, lighter on the sides ; abdomen whitish or yellowish ; back and sides, and in some the opercles, with blackish or brownish spots, in form, number and size liable to individual variations ; dorsal and anal spines and membranes silvery, minutely dotted with black, imparting to the latter a more or less intense colour ; dorsal, caudal and anal rays of the ground colour of the body, their membranes more or less intense black, with or without some smaller spots like those of the body ; ventrals greyish or whitish, minutely dotted with black ; pectorals whitish. Iris brown or blackish with a narrow golden circle round the pupil.

D 10—1/18, C 174, A 4/14, V 1/5, P 18, Br. VI.

HABIT.—*Estuaries and sea of Pinang, Malayan Peninsula, Singapore.*

Malabar, Ceylon, Bay of Bengal, Gangetic estuaries, Java, Celebes, Madura, Moluccas, China Sea.

TOTAL LENGTH : 10 inch.

The young are generally of more brilliant colours ; in one taken in the Joomrah, one of the mouths of the Ganges, the dorsal spines and ventral fins were of a deep red. At Pinang this species is not very numerous. It is eaten by the natives, though many reject it on account of its reputed disgusting habits. In several examined in the estuaries of the Ganges, and at Pinang, the stomach contained remains of small fishes and crustacea. According to Bennett, it is in Ceylon angled on hooks baited with a kind of sea-weed ("Pendah,") of which this fish appears to be particularly fond.

GEN. *HOLACANTHUS*, *Lacépède* 1802.

With a large backwards pointed spine at the angle of the preopercle, the margins of which are toothed.

*HOLACANTHUS ANNULARIS*, (Bloch.)

*Chaetodon annularis*, Bloch. Tab. 215, Fig. 2.

*Chaetodon annularis*, Linné : Syst. 1262.



*Holacanthus annularis*, Lacépède IV, 526, 533.

*Chaetodon annularis*, Shaw, IV. 330, Pl. 47.

Russell, LXXXVIII. Sāhni Tchapa.

*Holacanthus annularis*, Cuv. R. A. II. 192 (\*).

*Holacanthus annularis*, Cuv. and Val. VII. 178.

Ground colour of the body and fins light brown with golden lustre, darker on the head; external half of soft dorsal and anal blackish; scales of the body with a central blackish spot; at a little distance above the shoulder and opercle a ring of deep blue, internally and externally edged with black; on the body a number of similarly coloured oblique, slightly arched bands: the anterior, from the 7th dorsal spine, obliquely downwards, terminating a little below the ring; the second from the 10th dorsal spine; the third from the 4th dorsal ray joins the termination of the two preceding bands; the succeeding radiate from about the 5th dorsal, each describing a larger arch, the fourth terminating opposite the point of the opercle; the fifth in the axilla, the sixth, seventh and eighth, which latter passes along the base of the anal, terminate between the root of the pectoral and ventral; the ninth passes vertically in front of the caudal fin, spanning the soft anal; the tenth and eleventh follow the course the ninth. From the orbit a short horizontal blue black edged band, which on the opercle divides in three branches, of which the lower passes obliquely down to meet the fourth of the body; from the nostrils to the upper part of the preopercle another horizontal band. Dorsal and anal spines white, covered by the brownish membrane; caudal, ventral and pectoral rays, light yellowish brown, membrane dark brown; the large preopercular spine white, the shallow groove on the external surface filled with a brown membrane; to the slightly convex upper margin is attached a black, loose membrane. Iris brownish golden, the orbital half speckled with black.

D 13/22, C 17 $\frac{1}{2}$ , A 3/21, V 1/5, P. 18, Br. VI.

HABIT.—*Sea of Pinang.*

Moluccas, Malacca, Pondicherry, Vizagapatam.

TOTAL LENGTH: 1 foot.

In November 1843 a single individual was observed at Pinang. From the descriptions and figures published, it appears that the number and distribution of the bands are liable to individual variations.

In the one examined, the length of the entire fourth dorsal ray did not exceed that of the first ventral, whereas it commonly projects beyond the caudal fin. The figure of Russell is defective in not representing the loose membrane attached to the superior concave margin of the large spine, nor the dentitions of the margins of the preopercle.

GEN. PLATAX, Cuvier 1817.

Teeth setaceous, external series trilobate; body very compressed and high; dorsal spines few, hid in the anterior margin of the fin; anterior rays of dorsal, anal and ventral fins elongated, in some falciform.

PLATAX VESPERTILIO, (Bloch).

ADULT.

*Chaetodon vespertilio*, Bloch. Pl. 199, Fig. 2.

*Chaetodon vespertilio*, Linné, Syst. 1257.

*Chaetodon vespertilio*, Shaw, IV. 344.

*Platax vespertilio*, Cuv. R. A. 1817 II. 334, (\*).

*Platax vespertilio*, Rüppell: Atlas, 143 (Verzeichniss) Note 5.

*Platax vespertilio*, Cuv. R. A. 1829, 193, (\*).

*Platax blochii*, Cuv. and Val. VII. 22.

*Platax vespertilio japonicus*, Temm. and Schl. Faun. Jap. Pisces, 83,  
Tab. XLIII.

*Platax vespertilio*, Richardson, Report 1845, 245.

*Platax blochii*, Bleeker: Verh. Batav. Gen. XXII. 5.

Head and body pale bluish silvery brown, lighter on the cheeks, opercles, throat, sides and abdomen; the scales minutely dotted and edged with blackish brown, and sometimes with a few scattered small dark spots on the sides; the ocular, pectoral and caudal band indistinct; basal half of dorsal and anal fins like the body; upper half blackish; the rays whitish; caudal pale greyish transparent; posterior margin blackish; ventrals blackish; pectoral rays brownish yellow, with a broad brownish band at the base. Iris brownish golden, vertically divided by the ocular band.

D 5/36, 37, 38 or 39, C. 17 $\frac{1}{4}$ , A 3/25, 26, 27 or 28, V 1 $\frac{1}{5}$ , P 17 or 18, Br. VI.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Isle of France, Red Sea, Ceylon, Bay of Bengal, China

Sea, Japan, New Guinea, Amboina, Java, Madura.

TOTAL LENGTH: 7 inch.

The greatest height\* of the body is a little less than  $\frac{1}{2}$  of the total length or equal the distance from the symphysis of the lower jaw to the termination of the dorsal and anal fins.

YOUNG.—VAR. A.

Seba III. 25, Fig. 15?

*Chaetodon pinnatus*, Linné: Mus. A. F. Pl. 33, Fig. 6?

*Chaetodon pinnatus*, Linné, Syst. 1241?

*Chaetodon vespertilio*, Bennett: Ceylon No. 5.

*Platax ehrenbergii*, Cuv. and Val. VII. 221.

*Platax ehrenbergii*, (*Syn. vespertilio*) Rüppell: N. W. Fische, 33.

*Platax ehrenbergii*, Richardson, Report 1845, 245.

Head, body, dorsal and ventral fins light rust-coloured, or reddish ochre, lighter on the sides and abdomen, minutely dotted with black; on the forehead above the centre of each orbit a brown dot; from the occiput through the iris to the ventral spine a more or less distinct, often interrupted, blackish brown band; traces of a second such from the anterior dorsal spine to the pectoral fin; in some a blackish spot at the base of the anterior dorsal fin and a corresponding smaller at the base of the anal; a blackish spot at the termination of the base of the dorsal and anal fins; caudal pale reddish yellow with a vertical reddish brown band at the base; pectorals pale yellow, in some with a brownish line along the base. Iris golden of the ground colour of the body, vertically divided by the ocular band.

Total length from  $1\frac{1}{2}$  to  $4\frac{1}{2}$  inch.

YOUNG.—VAR. B.

Flaming No. 199, Cambing.

Valentyn No. 62.

Renard Pl. 24, Fig. 129.

*Platax albipunctatus*, Rüppell: Atlas, 69, Tab. 18, Fig. 4.

*Platax guttulatus*, Cuv. R. A. II. 193 (?).

*Platax guttulatus*, Cuv. and Val. VII. 227 Pl. 186.

*Platax vespertilio*, Rüppell: Neue Wirbelth. Fische, 33.

Head and body pale silvery chocolate coloured; cheeks, opercle, throat and abdomen bluish white; on the forehead above each orbit a brown dot; from the occiput through the iris to the ventrals, a

\* In the present and in the two succeeding species, it is calculated from the first dorsal to the first anal spine.

continued or interrupted dark brown band, or light brown with dark edges; from the first dorsal spine to the pectoral more or less distinct traces of a second band; on different parts of the body some scattered pearl-coloured spots, with dark brown edges and of irregular shape; base of dorsal and anal of the ground-colour of the body; rest of their membranes bluish white dotted with black; their margins blackish; rays light greyish; base of the caudal of the ground-colour of the body with a vertical, forwards arched, dark brown band; rest of the fin pale yellow; ventrals blackish; the fifth ray and its membrane whitish, minutely dotted with brown; pectorals yellowish white. Iris pale chocolate coloured, with a narrow golden ring, vertically intersected by the ocular band.

TOTAL LENGTH:  $1\frac{1}{2}$  to  $3\frac{1}{2}$  inch.

In individuals of the given dimensions, the greatest height equals the length of the body to the centre of the dark band on the caudal fin, or it is about  $\frac{1}{3}$  less than the total. The elongation of the anterior dorsal, anal and ventral rays is liable to individual variations, the maximum of the two former fins not exceeding  $\frac{1}{2}$  of the greatest height of the body. The ventrals never exceed  $\frac{1}{3}$  of the greatest height. On each side of the lower jaw appear three minute distant pores. In the early age the teeth of the two or three external series are trilobate, but they become blunter with age. At Pinang young individuals with pearl-coloured spots, appear to be of rarer occurrence than the others.

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The intestinal canal is nearly twice the length of the fish; of the five cæcopyloric appendages the three larger are of nearly equal length; the other two are very minute; the air-vessel is lanceolate, very thin, pearl coloured. In individuals of all ages the stomach contained remains of fishes and crustacea. Dr. Rüppell adds *Platax gaynardi*, Cuv. and Val. (VII. 216) to the synonymes of the present species.

PLATAX TEIRA, (Forskål).

*Chaetodon pinnatus*, Chinens. Lagerstr. No. 25?

*Chaetodon teira*, Forskål, 60 No. 82, Tab. XXII.

*Chaetodon teira*, Bloch, Tab. 199 Fig. 1.

*Chaetodon teira*, Linné, Syst. 1265.

*Chaetodon teira*, Shaw, IV. 345, Pl. 48.

*Platax teira*, Cuv. R. A. II. 193 (').

*Platax teira*, Rüppell : Atl. 68.

*Platax teira*, Cuv. and Val. 226.

*Platax teira*, Rüppell : Neue Wirbelth. Fische 33, 37.

*Young.* Ground colour of the body, dorsal, anal and ventral fins pale silvery whitish, the scales edged with blackish brown or deep purple; opercles, throat and abdomen bluish white, minutely dotted with black; from the occiput, through the iris over the ventral soft fin a blackish band; a second from the anterior margin of the dorsal fin, spreading over the dorsal spines, continuing vertically over the posterior part of the opercle to the abdomen; a third over the posterior part of the dorsal, the body and the anal fin and over the base of the caudal; the rest of the caudal and the pectorals whitish. Iris pale golden, vertically divided by the ocular band.

*Older.* The vertical bands very indistinct; dorsal, anal and ventral fins bluish black or brown; caudal greyish brown, the margin blackish. Iris blackish or brownish with a narrow golden ring round the pupil.

D 531 or 32, C 17 $\frac{1}{4}$ , A 3 $\frac{2}{3}$ , 24 or 25, V 1 $\frac{1}{5}$ , P 17, Br. VI.

*HABIT.*—*Sea of Pinang, Malayan Peninsula, Singapore.*

Red Sea, Malabar, Bay of Bengal.

**TOTAL LENGTH:** 8 inch.

The greatest height equals the length of the body, the caudal fin not included; the latter, as also the head, being  $\frac{1}{4}$  of the total length. The elongation of the anterior rays of the dorsal, anal and ventral fins is comparatively greater in young than in older individuals; in all, however, it is liable to considerable individual variations. The dorsal and anal are either equal or differing: in the young their greatest elongation exceeds by  $\frac{1}{4}$  the greatest height of the body. The ventrals often differ among themselves: in the young their greatest length does not exceed the greatest height of the body, in older ones it slightly exceeds one half of that distance. On each side of the lower jaw appear three small distant pores. At Pinang smaller individuals occur at all seasons; larger ones are less frequent.

**PLATAX ARTERITICUS**, Cuv. and Val.

*Ecan bonna*, Bell : Philosoph. Transact. 1793.

*Chaetodon arthriticus*, Cuv. and Val. VII. 229.

Head, back, sides, dorsal, caudal and anal fins dull chocolate brown or lead coloured, in some largely marbled with dark brown; abdomen

pale whitish; ventrals brownish yellow; pectorals whitish. Iris of the ground colour of the body, with a narrow golden ring.

D (5)/31, C  $17\frac{1}{2}$ , A (3)/23, V  $1\frac{1}{5}$ , P 17, Br. VI.

HABIT.—*Sea of Pinang, Singapore.*

Java, Sumatra.

TOTAL LENGTH: 1 foot 7 inch.

The dorsal and anal spines are so completely hidden, that they are imperceptible to the touch, but on close inspection their points may be perceived through the integuments. The greatest height equals the distance from the muzzle to the termination of the dorsal and ventral fins. The diameter of the eye is  $\frac{1}{4}$  of the length of the head, which is about  $\frac{1}{4}$  of the total. The large arched occipital crest, and the nodulous enlargement of some of the bones render this species easily distinguishable. On each side of the symphysis of the upper jaw appears a minute pore, and five somewhat larger on each side of the lower jaw. At Pinang this species is not numerous, although from October till January eight or ten are sometimes captured at the time in the fishing stakes. The flavour is considered excellent. The large air-vessel is too thin, and yields too little isinglass to become of value.

PLATAX OCELLATUS, Cuv. and Val.

*Platax ocellatus*, Cuv. and Val. VII. 229.

Ground colour of body and fins pale ochreous silvery; with one frontal and five lateral ferruginous bands, edged with black: a narrow frontal band along the profile of the head to the point of the muzzle; the first lateral from the occiput, describing a forwards directed arch, through the iris, over the cheek to a little in front of the ventrals; the second, less arched, from in front of the dorsal, bordering on the opercle, enclosing the base of the pectoral to midway between the ventrals and anus; the third following obliquely the two or three posterior dorsal spines, proceeds a little backwards down the side, to the anterior margin of the anal; the fourth, the broadest, from between the spine and soft part of the dorsal, describing a slightly backwards directed arch down the side and over the anterior third of the anal; at the base of the dorsal within this band a large rounded or oval black spot; the fifth band follows the margin of the soft dorsal; in front

of the caudal, within the black edges of this band, a vertical oval black spot with a broad white margin; the rest of the band following the margin of the soft anal, successively joins the fourth and third preceding bands; the dorsal spines and the angle they form with the rays of a brilliant orange, which spreads over the origin of the fourth and fifth bands. Anterior half of caudal ferruginous, posterior whitish, bluish or blackish towards the margin; pectorals yellowish white; ventrals milky white, the marginal half of the soft part black. Iris pale golden, vertically divided by the anterior lateral band.

D 6 or 7/29 or 30, C 17½, A 3/19 or 20, V 1/5, P 15, Br. VI.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

TOTAL LENGTH: 3¼ inch.

The length of the head is a little less than ¼ of the total, its greatest vertical diameter slightly exceeding the length. The eye is situated a little above the centre of the vertical diameter of the head, close to the profile; the diameter is a little less than ½ of the length of the head, equal the distance across the forehead. The form of the body is broad oval, the back and abdomen forming uniform arches, interrupted by the somewhat horizontally protracted muzzle. The greatest height of the body, from the root of the fourth dorsal ray to the first anal spine, exceeds by ½ half the total length. The mouth is very small, slightly protractile, the lower jaw longer than the upper; the teeth setaceous, all uniformly pointed, none trilobate. The anterior dorsal spines are very short, the rest gradually increase, the last equalling the length of the head. The two or three anterior rays, the longest, slightly exceed ¼ of the greatest height of the body; the extent of the base of the dorsal fin equals the length of the body, the head and caudal not included. The posterior margin of the caudal is slightly arched; the length of this and the pectoral fins is about ¼ of the total. The third anal spine equals the fifth dorsal; the two anterior rays, the longest, measure ½ of the longest dorsal rays; the extent of the base of the anal is less than ¾ of that of the dorsal. The ventral spine equals the fifth dorsal spine; the first ray is elongated, about the length of the head. The scales are rather large, orbicular, finely ciliated; the lateral line continues straight to a short distance from the head, where it rises to a moderate arch, gradually approaching the back till suddenly terminating beneath the last dorsal rays. The pro-

portions and the colours are the same in all ages. The uniformly setaceous teeth, the comparatively less height of the body and elongation of the dorsal and anal fins are characters which remove this species from the rest, and approach it to the Genus *Chaetodon*. As above observed, the peculiar distribution of colours bears a striking resemblance to that of *Chelmon rostratus*, (Linné). During the month of May 1840 numerous individuals were daily observed in the fishmarket at Singapore. At Pinang single individuals occur during all seasons. The fish is eaten both fresh and dried by the natives, although reputed indifferent and bony.

GEN. MONODACTYLUS, *Lacépède*. 1800.

Body compressed; dorsal and anal scaly, more or less falciform, with their spines hid to the point in the anterior margin; teeth close, velvety; ventral spines minute, the latter so as easily to escape observation.

MONODACTYLUS RHOMBEUS, (Forskål.)

*Scomber rhombeus*, Forskål. Fauna Arab. 58, No. 78.

*Centrogaster rhombeus*, Linné: Syst. 1338.

*Centropodus rhomboidalis*, Lacépède III. 303, 304, 305.

Russell, LIX. Kauki Sandawa.

*Psettus rhombeus*, Cuv. R. A. II. 193 (\*).

*Psettus rhombeus*, Cuv. and Val. VII. 245.

*Monodactylus rhombeus*, Swainson II. 212.

*Adult.* Profile of the head and back black; the rest above the lateral line golden green; sides of the head, opercles, and the body beneath the lateral line pale silvery; from the anus to the anal fin a black line; from the occiput to the centre of the upper margin of the orbit an oblique black band, continued through the pale golden iris, and in some over the cheek; a second similar band from the first dorsal spine to the point of the opercle; anterior margin of dorsal and the angle formed by the anterior six or eight rays black; the branched part of the succeeding rays gamboge, minutely dotted with black; the rest of the fin golden green; caudal gamboge, margin black or blackish; anterior margin of anal and the angle formed by the anterior four rays bluish black; the branched part of the succeeding rays pale bluish or blackish, minutely dotted with black; the rest of the fin greenish



or bluish silvery ; anal spines and rays white, the latter minutely dotted with black ; pectorals yellowish white.

*Young.* Like the adult, but the head, body, dorsal and anal fins, minutely dotted with black, in some so closely, as to impart a general blackish colour.

D 8/28, 29 or 30, C 17½, A 3/29 or 30, V 1/3, 4 or 5, P 17 or 18,

Br. VI.

*HABIT.*—*Sea of Pinang, Malayan Peninsula, Singapore.*

*Isle of France, Red Sea, Coromandel.*

*TOTAL LENGTH :* 5½ inch.

The length of the head is contained 3½ times in the total ; its greatest vertical diameter is ½ of the total length. The diameter of the eye is contained 2½ times in the length of the head, but equals the distance across the forehead. The height of the body, between the origin of the dorsal and anal fins, is contained about 1½ time in the total length : it equals the distance from the centre of the anterior part of the orbit to the termination of the dorsal and anal fins. Vertically measured, the dorsal equals the length of the head ; the anal is somewhat more ; it nearly equals the greatest vertical diameter of the head or about ½ of the total length. The ventral spines are very short, but strong, each being ⅓ of the length of the head ; at the base both are almost in contact, but their points diverge. The ventral rays of each fin are contained in a small groove in the body ; they are very minute and their number not only varies from 5 to 3 in different individuals, but also on either side in the same individual. The proposed genus *Psettus*, Cuv. and Val. 1831, is characterised as having no palatal teeth, which, as far as the present species is concerned, is a mistake. Forskål's diagnosis of *Scomber rhombeus* says : "*dentes numerosi subtiles. Lingua obtusa, prope apicem superne callo ovali, plano, albido, scabro,*" which is perfectly correct. All the teeth are velvety, "*en velours ras et serré ;*" those of both jaws appear like narrow bands ; of the vomer like a small rhombic elevation ; of the palate on each side like a lancet-shaped line, broader in front ; of each of the pterygoid bones like a triangular band, broader than the rest, and with the apex in front. On the oval tongue the teeth occupy the middle, leaving the margin naked. Single individuals occur during all seasons at Pinang, where they are eaten by the natives.

GEN. PIMELEPTERUS, *Lacépède* 1802.

Body oval, compressed; dorsal single, its rays, as well as those of the caudal and anal, covered with scales; the single external series of maxillary teeth trenchant, fixed by means of a horizontal posterior process resembling a talon.

## PIMELEPTERUS OBLONGIOR, Cuv. and Val.

*Pimelepterus oblongior*, Cuv. and Val. VII. 264.

*Adult?* Head above and back blackish brown; the scales silvery brownish grey, edged with brown: those above the lateral line with darker brown than those below; each series of scales longitudinally separated from the succeeding by a lighter or darker ferruginous stripe, imparting to the body a striped appearance; from beneath the eye, over the cheek and opercle a ferruginous stripe; a second continued or interrupted, from behind the orbit to the point of the opercle; on the occiput some irregular ferruginous spots. Dorsal and anal spines and membrane pale greyish brown, or neutral tint, minutely dotted with brown; soft portion of dorsal, anal and the caudal of the ground colour; their marginal part blackish; ventrals pale bluish grey, minutely dotted with brown, marginal half blackish; pectoral rays buff, membrane transparent; the scales of the base and those between the rays like those of the body. Iris silvery near the pupil, the rest bluish black or brown.

*Young.* Ground colour of the body paler and with a bluish tint; lateral stripes paler and fewer.

D 11/12, 14 or 15, C 17½, A 3/12, 13 or 14, V 1½, P 18 or 19, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula.*

TOTAL LENGTH: 7½ inch.

The length of the head is contained less than four times in the total: its height at the occiput equals the length. The eye is situated above the centre of the head, nearer the muzzle than the gill-opening: its horizontal diameter is about  $\frac{1}{3}$  of the length of the head. The greatest vertical diameter of the body slightly exceeds  $\frac{1}{3}$  of the total length. The number of external maxillary teeth appears to increase with age: the largest individual examined had 30 in each jaw. Their size decreases from the centre towards the angles of the mouth; the posterior, horizontal process is slightly longer than the anterior trenchant one. Behind the external series is a narrow crescent-shaped

naked space, from the posterior concave margin of which rises a single series of minute, distant, backwards arched teeth. On the vomer appears a transversely oval elevation with velvety teeth; on each palatal bone a narrow line, and on each pterygoid a broad lanceolate elevation with similar teeth. The tongue is small, but broad, rounded in front; on each side of the base appears a small oval spot of velvety teeth. The largest individual presented nine longitudinal series of scales above the lateral line, eighteen below, the longest of which contained 52 scales. The anal spines gradually increase in length: the posterior, the longest, is less than  $\frac{1}{3}$  of the length of the succeeding ray. From the figure of *Pimelepterus boscii*, Lacépède (Cuv. and Val. Pl. 187,) it would appear, that in that species the second and third anal spines are of equal length. At Pinang single individuals of the present species occur, but rarely, during all seasons. The flavour is said to be very good.

GEN. PEMPHERIS, Cuvier 1829.

Anal fin long, scaly; dorsal short, elevated; head obtuse; eye large; opercle with a small spine; velvety teeth in the jaws, on the vomer and palatal bones.

PEMPHERIS MOLUCCA, Cuv.

*Pempheris molucca*, Cuv. R. A. II. 195 (').

*Pempheris moluca*, Cuv. and Val. VII. 306.

*Pempheris molucca*, Temm. Schl. Fauna Japon. Pisc. 85, Pl. XLIV.

Fig. 3.

*Pempheris moluca*, Richardson, Report 1845, 244.

*Young.* Head above and back pale metallic copper-coloured, lighter on the upper half of the sides; cheeks, opercles and abdomen silvery with golden and steel-blue reflections; all parts minutely dotted with brown, on the opercles and cheeks so closely as to acquire the appearance of a brown band following the posterior and the inferior margin of the orbit; lateral line pale orange; fins pale reddish yellow; the scaly portion of the dorsal, caudal and anal coloured and dotted like the body; the upper half of the dorsal spines and membrane so closely dotted with reddish brown, as to acquire a general brownish appearance. Iris pale golden round the pupil; the rest minutely and closely dotted with black.

D 6/9, C 17 $\frac{1}{2}$ , A 3/42, V 1/5, P 19, Br. VII.

HABIT.—*Sea of Pinang.*

Moluccas, Batavia, Japan.

TOTAL LENGTH :  $3\frac{1}{4}$  inch.

The length of the head is contained  $4\frac{1}{2}$  times in the total : its greatest vertical diameter equals the length. The profile between the eyes is not convex, but somewhat concave, owing to a slight projection of the upper margin of the orbit, thus intersecting the profile. The diameter of the eye is a little less than  $\frac{1}{2}$  of the length of the head ; the orbit occupies the upper half, nearer the muzzle than the gill-opening. The greatest vertical diameter of the body, at the origin of the dorsal fin, is about  $\frac{1}{2}$  of the total length. The stomach is thick, leathery, with four larger and two smaller appendicula cœcopylorica. The intestinal canal is  $\frac{2}{3}$  of the length of the fish. The gall bladder is long, linear. The air-vessel large, thick ; the anterior third is rounded, joined by a constriction to the posterior oval portion. A single young individual was observed at Pinang in May 1845.

GEN. TOXOTES, *Cuvier* 1817.

Body short and compressed ; dorsal-fin placed on the posterior half of the back, with very strong spines ; soft part of dorsal and anal scaly ; muzzle depressed, short ; lower jaw projecting beyond the upper ; velvety teeth in the jaws, vomer, palatals, pterygoids and on the tongue ; lower margin of infraorbital and preopercle finely toothed ; branchiostegous rays 7.

TOXOTES JACULATOR, (Pallas).

*Sciæna jaculatrix*, Pallas : Spicil. Fasc. 8, 41.

*Sciæna jaculatrix*, Hommel : Phil. Transact. LVI. 1766. p. 187.

*Scarus schlosseri*, Linné : Syst. 1282.

*Sciæna jaculatrix*, Bonnaterre : Encycl. Method. Pl. d'Ichthyol. 121.

*Scarus schlosseri*, Lacépède IV. 5, 17.

*Labre sagittaire*, Lacépède III. 425, 463.

*Scarus schlosseri*, Shaw, IV. 398.

*Labrus jaculator*, *ibid.* 485, Pl. 68.

*Toxotes jaculator*, Cuv. R. A. II. 196.

*Coius chatareus*, Buchan. Hamilton, 101, 370, Pl. 14, Fig. 34.

*Toxotes jaculator*, Cuv. and Val. VII. 314, Pl. 129.

*Toxotes jaculator*, Swainson, II. 214.

## VAR. MALACCENSIS, Cuv. and Val.

Cuv. and Val. VII. 320.

Ikan sumpit or Sa sumpit of the Malays.

Head above silvery olive green, brown or blackish, all the rest silvery buff or greyish; all the scales with minute brown dots, either spread or collected round the centre, so as to produce faint brownish longitudinal lines; along the side five large rounded spots: the first on the occiput in front of the opercle; the second behind the opercle, intersected by the lateral line; the third between the spiny and soft dorsal; the fourth close to the termination of the soft dorsal; the fifth at the upper half of the root of the caudal; above this series another of smaller black spots, viz. one between the first and second lower spots; another between the second and third; a third at the centre of the base of the soft dorsal; in some the upper series of spots is confluent along the back; some have a small black spot on the symphysis of the lower jaw. Dorsal spines and membrane either brownish black or greyish, minutely dotted with black; the soft dorsal silvery olive, with a large oblique black spot joining the third of the upper dorsal series; another spreading over the upper half of the posterior seventh or eighth ray; margin of the soft portion black; caudal bright gamboge with a more or less distinct black, backwards arched band behind the root; upper half of anal silvery olive or greyish green, lower half black; pectorals and ventrals white, the latter with a large black spot, in some occupying nearly the whole space between the first and fourth ray. Iris bright gamboge or orange, blackish towards the orbit.

D 5/12 or 13, C 17½, A 3/15, 16 or 17, V 1/5 P 13 or 14, Br. VII.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*New Guinea, Isle of Búru, Java, Malabar, mouths of the  
Ganges.

TOTAL LENGTH: 7 inch.

This appears to be the variety, described by M. M. Cuvier and Valenciennes from a drawing in the series, formerly in the late Colonel Farquhar's possession. The food of several examined, consisted of remains of crustacea. In the Straits of Malacca this fish occurs, but not numerously, at all seasons. It is eaten by the Malays, who record its habits in the denomination: *ikan* signifying a fish, *sumpitan* a blow-pipe.

## FAM. TÆNIOIDÆ.

GEN. CEPOLA, Linné 1766.

Body elongated, compressed like a sword-blade; dorsal and anal fins very long; caudal pointed; ventrals attached under the pectorals; muzzle obtuse; jaws opening nearly vertically, with pointed teeth; the ventrals are the only fins preceded by a bony spine.

CEPOLA ABBREVIATA, Cuv. and Val.

Cepola abbreviata, Cuv. and Val. X. 403.

Cepola variegata, Swainson II. Appendix, 402.

Head above carmine; cheeks and opercle paler; jaws, preopercle and throat silvery whitish; back deep flesh-coloured, paler, with silvery reflections on the sides and abdomen, pale bluish under the pectorals; lateral line silvery; along the middle of the sides a longitudinal series of about 14 round, distant, orange, or cornelian-red spots, gradually decreasing in size towards the caudal; dorsal and anal rose-coloured, deepening to crimson on the marginal half; anal edged throughout, dorsal at the posterior part, with dark purple; membranes sparingly dotted with brown; caudal rays black; membrane cornelian-red; pectorals transparent, ventrals white. Iris silvery rose-coloured, orbital margin black.

D 72 or 74, C 13, A 74, V  $1\frac{1}{5}$ , P 19, Br. VI.HABIT.—*Sea of Pinang.*

Moluccas, Anjer (Java,) China.

TOTAL LENGTH:  $7\frac{1}{2}$  inch.

The length of the head is  $\frac{1}{3}$  of the total; the depth at the occiput  $\frac{2}{3}$  of the length. The distance from the muzzle to the eye is  $\frac{1}{3}$  of that from the muzzle to the point of the opercle. The diameter of the eye is  $\frac{1}{3}$  of the length of the head. In each jaw appears a single series of small pointed recurved teeth, of which those near the symphysis are a little longer than the rest. There are about 24 on each side of the upper, 12 on each side of the lower jaw. On the lower margin of the preopercle appear five rather strong spines: two pointing obliquely backwards and downwards at the angle, and three, pointing forwards, along the margin. The cheeks and opercles are covered with scales, the rest of the head is naked. The vertical diameter at the pectorals nearly equals the length of the head; the diameter in front of the

caudal is scarcely  $\frac{1}{2}$  of the former. The body is covered with small rounded scales, considerably larger, however, than in *Cepola rubescens*, Linné. The lateral line, like a thin cord, consists of keeled scales. It proceeds from the upper part of the gill-opening obliquely upwards to the fourth dorsal ray, from whence it accompanies the base of the dorsal fin to the termination, which latter is joined to the caudal. The length of the longest dorsal ray is  $\frac{1}{2}$  of the vertical diameter of the body. The anal commences opposite the eighth dorsal ray; the longest rays slightly exceed those of the dorsal. The pectorals are rounded, their length is  $\frac{1}{12}$  of the total. The ventrals are situated a little in front of the pectorals, and are a little shorter; the first ray terminates in a filament reaching the anus, or origin of the anal fin; the fifth ray has three fourths of its length attached to the abdomen by a membrane. The caudal is pointed; its length is  $11\frac{1}{2}$  in the total. The stomach is small, but thickened. There are eight cæcopyloric appendages. The intestinal caudal is  $\frac{1}{2}$  of the length of the fish. The air-vessel is rather large, silvery. Two individuals occurred at Pinang in March and April 1845. The smaller, 4 inches in length, resembled the one just described, in colours and in the distribution of the spots; but it differed in the following dimensions. The length of the head was  $6\frac{1}{2}$  in the total, of which the caudal and the pectorals measured  $\frac{1}{2}$ . Both head and these fins, therefore, were proportionally considerably longer in the smaller than in the larger individual. The specimen in the Zoological Society's Museum, London, described by Mr. Swainson, measures one foot in length.

### FAM. GOBIOIDÆ.

#### GEN. GOBIUS, Linné, 1748.

Head depressed with pores between the eyes; dorsal fins two, distinct, rays of both flexible; ventral fins united at the edges, forming a circle; vent with a tubercle; body covered with scales, the free edges of which ciliated; teeth small, numerous; branchiostegous rays 5.

#### GOBIUS ELEGANS, Kuhl. and Van. Hasselt, VAR.

Buff with a tinge of olive, minutely dotted with brown; the upper half of the sides with 3 or 4 indistinct lines, each formed by a series of very short brown streaks, beneath which a series of indistinct brown spots; a blackish spot at the posterior margin of the orbit; a second

at the upper part of the root of the pectoral fin, and a third at the lower part of the root, spreading on the gill-membrane. Near the lower part of the root of the pectoral is a faint trace of a fourth brown spot. The membranes of the fins are of a very pale bluish green, minutely dotted with brown; those of the dorsals, particularly the second, with 3 or 4 indistinct series of blackish spots, and a few similar on the caudal membrane. The rays of the anterior dorsal have 2 or 3 series of brown spots. Iris pale greenish silvery, minutely dotted with brown.

D 6—1/3, C 18½, A 1/8, V 1/5, P 18, Br. V.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 3½ inch.

A single individual observed differs from *Gobius elegans*,\* found in Vanikolo, New Guinea, Java, and Bombay, in having one soft ray less in the 2nd dorsal and anal-fins; and slightly in colours, which differences however appear not sufficient to constitute a distinct species.

#### GObIUS KOKIUS, Cuv. and Val.

Russell LI. Koku.

*Gobius koki*us, Cuv. and Val. XII. 68.

*Gobius koki*us, Jacquemont, Atlas: Pl. 14, Fig. 3?

*Gobius koki*us, Jerdon, Madras Journ. XV. 148.

*Gobius koki*us, Bleeker: Verh. Batav. Gen. XXII. 24, 5.

Head above and back greenish brown, sides pale reddish yellow; abdomen white; the back with 5 large, distant, brownish spots; 5 similar on the sides, the latter disposed beneath the intervals of the former. The rays and membranes of the dorsal and caudal fins with brown spots distributed in transversal series, which, however, are frequently very indistinct, and in some scarcely perceptible. One or two brown spots appear in some at the root of the pectoral fins, the membrane of which and of the ventral and anal fins is whitish. The lower half of the anal and caudal membrane is blackish in some individuals. Iris golden, in some dotted with black.

D 6—1/3, C 16½ or 19½, A 1/8, V 1/5, P 20 or 21, Br. V.

HABIT.—*Fresh-water and sea of Pinang.*

Iale of France, Malabar, Coromandel, Orissa, Java, Madura.

TOTAL LENGTH: 8½ inch.

\* Cuv. and Val. XII. 58.



This species is closely allied to *Gobius giuris*, Buch. Ham. from which M. Valenciennes observes, it chiefly differs in the comparatively smaller eye, the diameter of which is  $\frac{1}{4}$  or  $\frac{1}{5}$  of the length of the head, while in *G. giuris* it occupies the second fourth of the length of the head.

Gobius sublitus, Cantor.

Pale greyish brown, lighter on the sides, abdomen buff; back and sides with six indistinct parallel longitudinal streaks, produced by a short brownish line dividing each scale; fin-membranes minutely dotted with brown; anterior dorsal with a central transversal whitish waved band, and a similar at the base; second dorsal and caudal with 4 or 5 transversal series of oval whitish spots; anal with a subterminal reddish white band; the posterior pointed part of this fin, as well as the outer half of the ventrals and pectorals, blackish. Iris pale golden.

D 6—1/9, C 15 $\frac{1}{2}$ , A 1/8, V 1/5, P 19, Br. V.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 3 inch.

The head is elongated,  $\frac{1}{4}$  of the total length, depressed; the breadth of the nape a little less than the depth, which equals  $\frac{1}{4}$  of the length of the head; the profile gently sloping; the cheeks and opercles tumid; the eyes are nearly vertical, occupying the second fourth of the head, and placed excessively close together; the muzzle pointed; the lower jaw slightly longer than the upper; the mouth very large, oblique, the angle situated beneath the posterior margin of the orbit. The teeth of both jaws are crowded, card-like, of unequal length, the external series shorter than the rest, distant, bent inwards. On each side of the symphysis of the upper jaw, on the internal series, is a pair of teeth in length exceeding all the rest. The anterior teeth of the inner series of the lower jaw are somewhat longer than the rest; the tongue is smooth flattened, crescent-shaped. The body is elongated, its greatest depth being about  $6\frac{1}{2}$  times in the total length. The scales are rather large, finely ciliated, with striae converging towards the centre of the posterior margin. The longitudinal series, from the root of the pectoral to the caudal, contains about 38 scales. The height of the first dorsal is  $\frac{1}{4}$  of the total length; the fifth ray

is slightly longer than the rest, and terminates in a short filament; the membrane is carried very close to the origin of the second dorsal, the height of which is  $\frac{1}{4}$  of the total length. In extent and height the anal is a little less than the former: the posterior extremity of both is pointed. The caudal, ventral and pectoral fins are a little pointed, of nearly equal length,  $\frac{1}{4}$  of the total. The species is not numerous: it appears to be closely allied to *Gobius biocellatus*, Cuv. and Val. (XII. 73), but it differs in its dentition and the filamentous fifth ray of the anterior dorsal.

GObIUS APOGONIUS, Cantor.

Back brownish, sides and abdomen buff, opercles minutely dotted with black. Back and sides with 5 or 6 parallel, sometimes interrupted, series of black spots; fin-membranes buff; on the anterior dorsal two elongated black spots, of which the posterior between the 4th and 5th ray; the second dorsal and anal fin with 2 or 3 transversal series of black spots, and with their free margins black; caudal edged with black with a number of somewhat irregular transversal series of black spots; ventrals with the extremities of the two central rays (the fifth) black. Iris pale golden, spotted with black.

D 6— $1\frac{1}{3}$ , C  $15\frac{1}{4}$ , A  $1\frac{1}{3}$ , V  $1\frac{1}{5}$ , P 18, Br. V.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 24 inch.

The general outline, the short robust make, and the large scales impart to this species a certain resemblance to the Genus *Apogon*. The head is about  $\frac{1}{4}$  of the total length, depressed, sloping; the muzzle broad, rounded; the eyes are lateral, near the upper profile, occupying the second fourth of the head; their distance across the head, and that from the lower margin of the orbit to the angle of the mouth, equals the diameter of the eye, or one fourth of the length of the head. The jaws are nearly semi-circular, the lower slightly projects beyond the upper; the mouth is obliquely cleft, the angle situated under the middle of the orbit. The teeth of both jaws are velvety, the external series of the upper consists of a few distant teeth, slightly larger than the rest; in the lower jaw there is a similar internal series, of which the two nearest the symphysis have the appearance of

small canines. The tongue is thin, narrow, crescent-shaped, and smooth. The profile of the forehead rises obliquely towards the first ray of the anterior dorsal, where the vertical diameter equals about  $\frac{1}{3}$  of the total length; from thence the arched profile of the back and abdomen gradually converge towards the last ray of the second dorsal and anal fins, the vertical diameter between which equals  $\frac{1}{2}$  of the total length, and such it continues to the root of the caudal. The height of the first ray of the anterior dorsal fin equals one half of the greatest vertical diameter; the second and third rays gradually increase; the fourth terminating in a filament, slightly exceeds the greatest vertical diameter of the body; but the sixth ray scarcely equals half the height of the first. The second dorsal and the anal fin are nearly opposite, on a backwards sloping level, their extent being somewhat less than  $\frac{1}{3}$  of the total length. Their sixth, divided, rays, are the longest and equal about one-sixth of the total length. Their first and last rays are about  $\frac{1}{3}$  of the total length. The distance between the anterior and second dorsal is about  $\frac{1}{3}$  of that between the latter and the caudal fin. The latter is rounded, about  $\frac{1}{4}$  of the total length. The pectoral fins are rounded, nearly as long as the caudal, and with the rays slightly filamentous. The ventrals are a little pointed, and scarcely exceed one half the length of the pectorals. The scales are generally very large, particularly on the crown of the head, and the opercles finely ciliated, and striated; their breadth double their length. The longitudinal series, from the root of the pectorals to the caudal, contains about 25 scales; the sides behind the second dorsal and the anal fins are covered by 5 vertical series.

A few individuals were occasionally observed among the fishes taken in the stakes off the coast of Pinang. This species is closely allied to another from the estuaries near Calcutta: *Gobius sadanundio*, Buchan. Ham. (*Gangetic Fishes*, 52,366) among whose duplicate series of drawings there is a representation. In the number of rays and the large size of the scales both agree, and the black markings of the fins and the body are also nearly the same. But *G. sadanundio* is of a strikingly more elongated shape, the third ray of the anterior dorsal fin is the longest, and the fourth is shorter not terminating in a filament. *Gobius filorus*, Cuv. and Val. (XII. 78) appears also to be allied to the present species.

**Gobius acutipennis,\* Cuv. and Val., VAR.**

Brownish buff with some indistinct blackish clouded spots on the back and sides; fin-membranes bluish white, minutely dotted with black; the two dorsals and the upper third of the caudal with indistinct transversal series of blackish spots. Iris blackish silvery.

D 6—1/12, C 17½, A 1/13, V 1/5, P 22, Br. V.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH : 3½ inch.

The rays of the first dorsal gradually increase towards the fish, which terminates in a filament, in length slightly exceeding  $\frac{1}{2}$  of the total. The second dorsal and the other fins are pointed; the length of the caudal is  $\frac{1}{2}$  of the total; that of the head slightly exceeds  $\frac{1}{2}$ . In both jaws the teeth are placed in a single series; those of the upper are a little longer and more distant than those of the lower; there are no canines. *G. acutipennis*, Cuv. and Val. has 10 branched rays in the second dorsal and 11 in the anal. But in proportions and colour it closely agrees with the present.

**Gobius criniger, Cuv. and Val.**

*Gobius criniger*, Cuv. and Val. XII. 82.

Pale ochreous with faint silvery lustre; abdomen whitish; head and upper jaw black; three round black spots on the cheeks; a fourth larger at the posterior angle of the orbit; a similar one on the opercle; on the sides three large rounded black spots: the anterior behind the pectoral fin, spreading on the back; the second below the posterior part of the second dorsal, and the third at the root of the tail. Between these spots several smaller, irregular black marks. The fin-membranes whitish, that of the ventrals minutely dotted with black. That of the two dorsals and the caudal with rather large black spots; the free margin of the caudal and anal black. Iris pale golden, blackish.

D 6—1/9, C 13½, A 1/9, V 1/5, P 17, Br. V.

HABIT.—*Sea of Pinang.*

New Guinea, Malabar.

TOTAL LENGTH : 2½ inch.

The occiput and the opercles are without scales; the rest of the body with large ciliated, faintly striated scales, of which the longitudinal

\* XII. 80.

series from the root of the pectoral to the anterior part of the caudal contains about 34. The length of the head is about  $\frac{1}{4}$  of the total. The second ray of the anterior dorsal is the longest, terminating in a filament; its length is double that of the greatest vertical diameter, or a little less than  $\frac{1}{4}$  of the total length. The teeth are minute, velvety, of nearly equal length. This species appears not to be numerous at Pinang.

GobiUS CYANOCLAVIS, Cantor.

Greenish-grey, paler on the abdomen; the scales with a central azure spot, forming on the body from 5 to 8 longitudinal series; the opercle and root of the pectorals with a few similar spots; anterior dorsal minutely dotted and clouded with brown; second dorsal black, pale at the base, upper margin orange, between the rays 3 to 5 white oval spots, forming transversal series; caudal similarly coloured, but with the upper half of the posterior margin orange; anal intenses, ventrals and pectorals paler black, the anterior margin of each of the anal branched rays accompanied by a blue streak. Genital papilla with an orange coloured apex. Iris golden, spotted with black; pupil strongly iridescent.

D 6— $\frac{1}{10}$ , C  $17\frac{1}{4}$ , A  $\frac{1}{10}$ , V  $\frac{1}{5}$ , P 19, Br. V.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 6 inch.

The head is a little depressed, the profile slightly sloping, the length  $\frac{1}{4}$  of the total; the breadth at the nape is contained  $2\frac{1}{2}$  times in the depth, which exceeds one half of the length of the head; the cheeks are tumid; eyes obliquely oval, nearly vertical, situated nearer the posterior angle of the preopercle than the muzzle; their greatest diameter is about  $\frac{1}{4}$  of the length of the head; their distance  $\frac{2}{3}$  of the greatest diameter; the muzzle is bluntly rounded, the lower jaw slightly projecting beyond the upper; the gape is wide, the angle of the mouth is beneath the posterior margin of the orbit. The teeth of the upper jaw are generally minute, but the anterior 4 or 5 on each side a little longer than the rest; the external series on each side of the lower jaw consists of 9 teeth, of which the two last towards the angle of the mouth are stronger, and much longer than the rest, and recurvous. These teeth M. Valenciennes compares with the fangs of venomous serpents. The other teeth are minute like those of the upper jaw. On the lower part of

the margin of the preopercle appear five pores of which the two upper ones are a little larger than the rest. The scales of the nape, of the opercle and of the root of the pectorals are much smaller than those of the body which are very large, finely ciliated and striated. The longitudinal series from the root of the pectoral to the caudal contains about 32 scales. All the rays of the anterior dorsal terminate in filaments: the third is the longest, equalling nearly half the total length; next to that is the fourth ray; the sixth is the shortest, but all except the third, are liable to individual variations. The posterior dorsal and anal fins are pointed, increasing in height towards the last, double, ray, which is about  $\frac{1}{2}$  of the total length. The caudal is contained  $4\frac{1}{2}$  times, the pectorals and ventrals 6 times in the total length: all these fins are broad, and a little pointed. The species is of no uncommon occurrence: it is closely allied to *Gobius caninus*, Cuv. and Val. (XII. 16).

#### GOBIUS RUSSUS, Cantor.

Flesh or pale salmon-coloured; back blackish; on each side 4 or 5 large clouded blackish spots, the scales of which have a minute vertical lanceolate whitish spot in the centre; first dorsal whitish at the base and at the upper margin, with two transversely waved blackish bands, separated by a white, which surrounds a large black spot between the 4th and 5th rays; posterior dorsal whitish, minutely dotted with brown, and with two irregular transversal series of pale blackish, clouded, spots; rays of dorsals and anal flesh-coloured; membranes of caudal, anal, ventral and pectoral fins whitish, minutely dotted with brown. Iris pale golden, spotted with black.

D 6— $1/10$ , C  $19\frac{1}{4}$ , A  $1/10$ , V  $1/5$ , P 18, Br. V.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH:  $4\frac{3}{4}$  inch.

The head is depressed, the profile slightly sloping from the eyes; the length equals that of the caudal, and is contained about  $4\frac{1}{2}$  times in the total length; the breadth at the nape is a little less than the height which is about  $\frac{1}{4}$  of the total; the cheeks tumid; the eyes oval, lateral, situated on the profile, occupying a little more than the second fourth of the head, nearer the muzzle than the angle of the preopercle; the muzzle is broad rounded; the lower jaw a little longer than the upper; the gape is wide, oblique, the angle is situated beneath the middle of the

orbit. The teeth are velvety; the 4 anterior on each side of the upper jaw are distant and longer than the rest. The external series of the lower jaw consists of five similar teeth on each side, the last of which is slightly recurved, but in length scarcely exceeding the four anterior. The space between the nape and the anterior dorsal is naked; the rest of the body is covered with small ciliated, striated scales, which are indistinct and almost hidden in the skin. The rays of the anterior dorsal terminate in short filaments; the first is the longest, scarcely exceeding the vertical diameter at the nape, or about  $\frac{1}{2}$  of the total length; the membrane closely approaches the posterior dorsal, which, as well as the anal, slightly increases in height towards the 9th branched ray, the length of which equals the first ray of the anterior dorsal. The caudal, ventral and pectoral fins are broad, slightly pointed; the length of the two latter is little more than  $\frac{1}{2}$  of the total. The species is not numerous: it closely approaches *Gobius phalæna*, Cuv. and Val. (XII. 92).

GEN. APOCRYPTES, Cuv. and Val. 1837.

(SCARTELAOS,\* Swainson, 1839.)

Ventral fins united as in *Gobius*; two dorsals; body elongated; caudal long, pointed (lanceolate); teeth pointed, distant, in a single series in both jaws, near the symphysis of the lower two teeth a little behind the rest; scales small.

APOCRYPTES LANCEOLATUS, (Bloch-Schneider).

*Eleotris lanceolata*, Bloch-Schneider, 67, Pl. 15.

*Gobius changva*, Buchan. Ham. 41,365, Pl. 5. Fig. 10.

*Apocryptes changva*, Cuv. and Val. XII. 145.

*Scartelaos calliurus*, Swainson, II. 280.

*Apocryptes changva*, Bleeker: Verh. Batav. Gen. XXII. 36, 5.

Head, cheeks and opercles blackish olive, bluish beneath; back blackish olive; sides greenish or bright gamboge mottled with blackish; abdomen whitish or rose-coloured; dorsal fins minutely dotted with black. The rays of the second in some with brownish spots; in the young both are transversely waved with pale brown; caudal with alternate vermiculated brownish and whitish lines, and at the upper part of the root a black ocellated spot; anal, ventrals and pectorals buff or pale yellowish. Iris buff.

\* By mistake characterised as being destitute of scales.

D 5—1/30 or 31, C 174, A 1/29, V 1/5, P 18, Br. V.

HABIT.—*Estuaries of Pinang, Malayan Peninsula, Singapore.*

Batavia, Madura, Rangoon, Pondicherry, estuaries of the

TOTAL LENGTH : 64 inch.

Ganges.

The species is numerous at Pinang.

#### APOCRYPTES NEXIPINNIS, Cantor.

Slate-coloured, lighter on the abdomen; throat bluish white; fin-membrane of the united dorsals and of the caudal minutely dotted with brown, giving the fins a greyish appearance; anal and ventrals transparent, pectorals blackish grey, divided in the middle by a crescent-shaped transparent band, which expands over the lowest eight rays. Iris slate-coloured.

D 6/26, C 174, A 1/25, V 1/5, P 21. Br. V.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH : 3½ inch.

The head is depressed, gently sloping before the eyes; the breadth at the nape exceeds the vertical diameter by one third, and equals ¼ of the length of the head; the latter is ½ of the total length; the eyes are vertical, oval, occupying the third seventh of the length of the head; their distance is somewhat less than their diameter. The muzzle is rounded, the lower jaw slightly projects beyond the upper; the gape is enormous, almost horizontal; the angle of the mouth marks the anterior half of the length of the head. The anterior tooth on each side of the symphysis of the upper jaw is excessively long, curved and projecting beyond the lower jaw when the mouth is closed. At a distance from these canines commences on each side a single series of 12 to 14 smaller, distant teeth, placed almost horizontally, and arched downwards. The thin membranous upper lip covers all the teeth except the two foremost, and has a small downwards pointed lobe beneath the anterior angle of the orbit. The lower jaw has on each side a single series of 10 to 12 distant teeth, horizontally placed and bent upwards. The first on each side of the symphysis is placed a little behind the rest, and it is the smallest; the succeeding four gradually increase in length; the two last are the longest of the series, which terminates with the anterior half of the jaw, and considerably in front of the teeth of the upper jaw. The tongue is very



narrow, almost linear, short, smooth, rounded in front and tied to the floor of the mouth. It is of a buff colour, but the cavity of the mouth is inky. The scales of the nape are very small and deciduous, so as to make the part appear naked; they gradually increase in size towards the posterior part of the body, where they are very large. They are orbicular with about 16 striæ. The body is compressed, the profile gradually narrowing towards the tail. The first dorsal ray is situated at the second third of the total length: its height is about  $\frac{1}{2}$  of the vertical diameter at the nape; the succeeding, undivided, rays gradually increase towards the 5th, which, as well as the 6th, are about  $\frac{1}{2}$  of the vertical diameter at the nape. The distance between the 5th and 6th, undivided, rays, and between the latter and the first branched ray is conspicuously greater than the distances between any of the preceding or following dorsal rays. The first branched ray is somewhat shorter than the 6th undivided, which produces a sinking in the upper margin of the connecting membrane, and indicates the transition from the undivided to the branched rays. The latter gradually increase in length towards the penultimate, which nearly equals the vertical diameter at the nape. The caudal is broad lanceolate, its length about  $\frac{1}{2}$  of the total. The first undivided ray of the anal is situated opposite the 3rd branched dorsal; the height of the fin is slightly less than that of the dorsal. The papilla immediately behind the anus is short, conical. The ventrals are rounded, their length equalling the vertical diameter at the nape; the transversal diameter exceeding the latter by one third. The pectorals are pointed, their length  $\frac{1}{2}$  of the total. It is not numerous at Pinang.

Although the dorsal fin is single, as it is in *Gobioides*, Lacépède, this species has the characteristic dentition of *Apocryptes*: it is in fact an *Apocryptes* with the two dorsal fins united, and as above observed, with the junction perceptible. The single character is of too little value to warrant the formation of a separate genus, particularly, as in *Apocryptes dentatus*, Cuv. and Val. (XII. 112) the membrane of the anterior dorsal is continued to the base of the second.

GEN. TRYPAUCHENA, Cuv. and Val. 1837.

Ventral fins united as in *Gobius*; the single dorsal, the caudal and anal united; on each side of the nape above the opercle a deep fossa.

**TRYPAUCHENA VAGINA, (Bloch).**

*Gobius vagina*, Bloch-Schn. 73, No. 20.

*Gobioides ruber*, Buchan. Ham., 38, 365.

*Trypauchena vagina*, Cuv. and Val. XII. 153, Pl. 351.

*Trypauchena vagina*, Swainson II. 279.

*Trypauchen vagina*, Richardson, Report 1845, 206.

*Trypauchena vagina*, Bleeker: Verh. Bat. Gen. XXII. 37, 5.

Rose-coloured with light blue reflections, paler towards the abdomen which is whitish; eyes minute, barely perceptible, like two blackish points; fins transparent, colourless.

D 6/47 to 49, C 17, A 1/49, V 1/5, P 17, Br. IV.

**HABIT.**—*Sea of Pinang.*

Sea, estuaries and freshwater of Bengal, Coromandel, Malabar, China Seas, Java, Madura, Balli.

**TOTAL LENGTH:** 8 inch.

Not numerous at Pinang.

**GEN. AMBLYOPUS, Cuv. and Val. 1837.\***

(*PSILOSOMUS*, Swainson, 1839).

Body elongated; ventrals like *Gobius*; dorsal, caudal and anal fins united; mouth vertical; in both jaws an external series of exposed, curved, distant teeth, longer than the rest; eyes very minute, hid by the skin, scarcely perceptible; no fossæ on the side of the nape.

**AMBLYOPUS HERMANNIANUS, (Lacépède).**

*Tænioides hermannien*, Lacépède, IV. 533.

*Cepola hermanniana*, Shaw, IV. 191.

*Cepola cæcula*, Bloch-Schneider, 241, Tab. 54.

*Gobioïde rubicundus*, Buchan. Ham., 37, 365, Pl. V. Fig. 9.

*Tænioides*, Cuv. R. A. II. 244.

*Amblyopus hermannianus*, Cuv. and Val. XII. 159, Pl. 350.

*Psilosomus*, Swainson, II. 183.

*Amblyopus hermannianus*, Swainson, II. 279.

Head and back brownish ochre; sides brick-red, paler on the abdomen, fins reddish ochre, caudal in some blood coloured.

D 6/44, C 15, A 1/45, V 1/5, P 15, Br. V.

Buchanan Ham.: D 46, A 40, V 12.

\* Substituted for *Tænioides*, Lacépède 1800, the definition of which, M. Valenciennes observes, is incorrect, and not complete.

Cuv. and Val.: D 6/40, C 15, A 1/37, V 1/5, P 15.

HABIT.—*Sea of Pinang.*

Estuaries and freshwater of Bengal, Rangoon, Tranquebar.  
Peiho river.

TOTAL LENGTH: 1 ft. 2 inch.

The height at the nape is from  $\frac{1}{12}$  to  $\frac{1}{10}$  of the total length; the length of the head is  $\frac{1}{3}$  to  $\frac{1}{2}$  of the total; the length of the pectoral fin is  $\frac{1}{12}$  to  $\frac{1}{10}$  of the total, and  $\frac{1}{3}$  of that of the ventrals. It is of no common occurrence at Pinang.

GEN. PERIOPHTHALMUS, (*Bloch-Schn.* 1801) *Cuv. and Val.* 1837.

Profile rapidly sloping at an obtuse angle where the eyes are situated; the latter are very close to each other, provided with a lower lid capable of covering the eye. Ventral fins in some entirely united, in others partially at the basal half; pectorals muscular at the base, covered with scales and appearing as if supported on arms. Teeth of both jaws in a single series, more or less horizontally placed.

PERIOPHTHALMUS SCHLOSSERI, (*Pallas*).

*Gobius schlosseri*, Pallas, *Spicil.* VIII. Pl. 1, Fig. 1—4.

*Gobius schlosseri*, Linné: *Syst.* 1201.

*Gobius schlosseri*, Lacép. II.

*Periophthalmus schlosseri*, Bloch-Schn.

*Gobius schlosseri*, Shaw IV. 246.

*Gobius schlosseri*, Raffles: *Linn. Tr.* XIII.

*Periophthalmus schlosseri*, Cuv. R. A. II. 245 (?).

*Periophthalmus schlosseri*, Bennett: *Life of Raffles*.

*Periophthalmus schlosseri*, Cuv. and Val. XII. 192.

*Periophthalmus schlosseri*, Swainson, II. 280.

*Periophthalmus schlosseri*, Bleeker, *Verh. Bat. Gen.* XXII. 39.

Ikan lāsah, \* Ksah, or lāsah of the Malays.

Upper part of the head and back blackish green or olive, cheeks and sides greenish gamboge, the scales with blackish edges and a large blackish spot at the upper angle of the opercle; throat and abdomen white. Anterior dorsal shining reddish brown, the upper margin whitish; second dorsal: upper margin and basal half brownish white, in the middle a broad obliquely upwards turned black band; posterior

\* *Lāsah*, restless.

part of the pectorals and caudal black; anal and ventrals whitish. Iris black with a narrow internal golden ring; eyes strongly iridescent.

D 8—1/12, C 16½, A 1/12, V 1/5, P 17, Br V.

**HABIT.**—*Estuaries of Pinang, Malayan Peninsula, Singapore.*

Amboina, Sumatra, Java.

**TOTAL LENGTH:** 10½ inch.

Some individuals have on one or both sides of the symphysis of the upper jaw a second, internal, short series of two or three small teeth. At Pinang this species occurs in great numbers in the moat of Fort Cornwallis, which is filled by each tide from the sea. Like the other Gobies it is very wary and difficult to capture, but unlike most of the others, it is very fierce when taken, and is capable of inflicting rather severe wounds with the long hooked teeth.

**GEN. BOLEOPHTHALMUS, Cuv. and Val. 1837.**

Differs from *Periophthalmus* in having all or the middle teeth of the upper jaw straight and strong; those of the lower jaw placed horizontally, all very fine, except two stronger than the rest, recurved, and placed a little inwards; head more oblong than *Periophthalmus*; scales small or imperceptible; anterior dorsal fin with five rays; the base of the pectorals not in all species covered with scales.

**BOLEOPHTHALMUS BODDAERTI, (Pallas).**

*Gobius boddaerti*, Pallas, Spicil. Zool. VIII. 11, Tab. 2, Fig. 4, 5.

*Gobius boddaerti*, Linné: Syst. 1201.

*Eleotris boddaerti*, Bloch-Schn. 66.

*Gobius striatus*, Bloch-Schn. 71, Tab. 16. (*Female*, Cuv. and Val.)

Russell LIV. Nettee Kunla Mottah.

*Gobius boddaerti*, Shaw IV. 238.

*Gobioides boddaerti*, Cuv. R. A. II. 244 (').

*Boleophthalmus boddaerti*, Cuv. and Val. XII. 199.

*Boleophthalmus boddaerti*, Richardson, Report 1845, 208, 319.

*Boleophthalmus boddaerti*, Tem. et Schl. Fauna Japon. 148, Tab.

LXXXVI. Fig. 3.

*Boleophthalmus boddaerti*, Bleeker: Verh. Bat. Gen. XXII. 40, 5.

Lips, upper part of the head and the back blackish green; sides greenish gamboge; abdomen white; the sides from the second dorsal with 6 or 7 obliquely backwards directed blackish bands, (not reaching

the abdomen); the whole body, pectorals and caudal with numerous verdigris spots; anterior dorsal pale brownish lilac with violet spots, the upper margin between the first four rays whitish; second dorsal brownish, whitish towards the base, between the rays two or three transversal violet bands edged with white, forming irregular transversal series; caudal with blackish rays; anal and ventrals whitish; pectoral membrane blackish. Eyes black, strongly iridescent.

D 5—1/24 to 26, C 16, A 1/25, V 1/5, P 19, Br. V.

HABIT.—*Estuaries and Sea of Pinang, Malayan Peninsula.*

Madura, Borneo, Java, Sea of China and Japan, Moluccas,  
Bengal, Coromandel, Malabar.

TOTAL LENGTH: 5 inch.

At Pinang the species is very numerous in the same localities as *Periophthalmus schlosseri*.

**BOLEOPHTHALMUS PECTINIROSTRIS, (Linné.)**

*Gobius pectinirostris*, Linné: *Chinens. Lagerstr.*—*Amoen. Acad.*

Dec. 1754.

*Apocryptes chinenses*, Osbeck: *It.* 130.—*Amoen. Acad.* IV. Pl. 3,

Fig. 3.

*Gobius pectinirostris*, Linné: *Syst.* 1200.

*Gobius pectinirostris*, Lacép. II. 542.

*Gobius pectinirostris*, Shaw IV. 245.

*Apocryptes pectinirostris*, Cuv. and Val. XII. 150.

*Boleophthalmus pectinirostris*, Richardson Report 1845, 208.

Head and back greyish green, lighter on the sides; abdomen whitish; the whole body with minute blackish tubercles, and with metallic sky-blue or verdigris spots; muzzle, lips, throat and posterior margin of the opercle pale greenish black; anterior dorsal greenish black with numerous vertically placed lilac spots; posterior dorsal greenish black with 6 or 7 transversal series of elongated lilac, black-edged spots, which between the 8 posterior rays become larger, but rarer; caudal brownish black with transversal series of indistinct lilac spots; anal, ventral and pectoral fins brownish; the base of ventrals greenish black, the anterior scaly part of the pectorals with a blackish crescent-shaped margin. Iris narrow golden; pupil strongly iridescent.

D 5—1/25, C 16½, A 1/25, V 1/5, P 20, Br. V.

HABIT.—*Sea coast of Pinang.*

Canton.

TOTAL LENGTH: 6 inch.

The length of the head is a little more than  $\frac{1}{2}$  of the total length, the height slightly exceeds the breadth and equals half the length. The vertical diameter at the anterior dorsal is  $\frac{1}{2}$  of the total length. The muzzle is rounded, the gape wide, the angle of the mouth is opposite the posterior angle of the orbit. The eyes are contiguous, situated a little behind the second fifth of the head; upper eyelid with tubercles; the lower membranous, hemi-transparent. The upper jaw has on each side of the symphysis three conical teeth, distant, and longer than the rest, of which there are upwards of 30 very minute, and distant, on each side. On the upper lip behind the canines appears a small flattened lobe. Each side of the lower jaw carries 30 to 34 horizontal, closely set teeth, which are long, almost setaceous, obliquely truncated at the apex. On each side of the symphysis, on a more inward level than the others, is a stronger, conical, vertical tooth. The tongue is small, rounded, fleshy, and fixed to the floor of the cavity, and as well as the latter inky. The anterior dorsal commences a little behind the root of the pectoral; the four posterior rays are filamentous: the third, the longest, is little less than  $\frac{1}{2}$  of the total length; the fifth, a little shorter than the first, equals about one half of the third; the membrane extends close to the posterior dorsal; the base of this fin equals the greatest vertical diameter of the body. The posterior dorsal slightly increases in height towards the 21st ray, which measures about  $\frac{2}{3}$  of the greatest vertical diameter of the body; the base of the fin is  $3\frac{1}{2}$  times its height. The caudal is a little pointed, the length little less than  $\frac{1}{2}$  of the total. The anal commences opposite the second branched ray of the posterior dorsal, the tract of which it follows, but its height is less by one third; the 23rd ray is the longest and less than one half of the greatest diameter of the body. The ventrals are infundibuliform, their length is about  $\frac{1}{2}$  of the total. Two thirds of the pectorals are covered with scales; their length is about  $\frac{1}{2}$  of the total; the naked portion of this fin is oval. The scales resemble those of *B. boddaerti*, increasing in size on the abdomen and posterior part of the body, deeply imbedded in the integuments, which are covered with numerous papillæ. Single individuals were observed at Pinang.

**BOLEOPHTHALMUS VIRIDIS, (Buchan-Ham.)**

*Gobius viridis*, Buchan. Ham. 42, 45, 366, Pl. XXXII. Fig. 12.

*Boleophthalmus viridis*, Cuv. and Val. XII, 213.

*Boleophthalmus histophorus*, Cuv. and Val. XII, 210.

*Scartelaos viridis*, Swainson II, 280.

Head and back greenish ; sides bluish-slate coloured ; above the indistinct lateral line more or fewer distant black dots ; in some a varying number of blackish vertical lines ; the festooned lips, the throat and abdomen bluish white ; dorsal fins greenish grey edged with black, the posterior one dotted with black ; caudal similar, but the black dots forming a few undulating transversal lines ; anal and ventrals pale rose-coloured or whitish ; pectorals greyish with a few scattered black dots. Iris pale golden.

D 5—1/26, C 17, A 1/25, V 1/5, P 17, Br. V.

HABIT.—*Sea of Pinang.*

Estuaries of the Ganges, Bombay, Surat.

TOTAL LENGTH : 5 inch.

From comparison of a number of living individuals it appears that the deeper or lighter greenish colour of the back, and the absence or presence of vertical lines on the sides are but individual differences, perhaps influenced by age, sex, or habits. Buchanan Hamilton correctly observes "there are very minute scales on the body and upper part of the head." They are imbedded in the skin, distant, orbicular or slightly oval, and become larger towards the tail. On submitting a portion of the skin to 60 or 100 linear magnifying power, the scales may be seen distinctly enough. This species is very numerous at Pinang.

GEN. *ELEOTRIS*, Gronov. 1763.

General structure of *Gobius*, but the ventral fins are not united ; branchiostegous rays six.

*ELEOTRIS POROCEPHALA*, Cuv. and Val.

*Eleotris porocephala*, Cuv. and Val. XII. 237.

Head and back blackish brown ; sides brownish white with clouded brownish spots ; abdomen brownish white minutely dotted with brown ; anterior dorsal pale brownish ; posterior dorsal and caudal darker with indistinct transversal series of brownish spots, their free margin whitish ;

anal, ventrals and pectorals whitish hemi-transparent. Iris golden, more or less spotted with black.

D 6— $1/8$ , C  $17\frac{1}{2}$ , A  $1/7$ , V  $1/5$ , P 15, Br. VI.

HABIT.—*Freshwater Pinang.*

Freshwater Seychelle Islands, New Ireland.

TOTAL LENGTH:  $5\frac{1}{4}$  inch.

The pore a little above the posterior nostril, and that immediately behind the orbit are indistinct in the two young individuals examined; the uppermost of the four pores on the posterior ascending margin of the preopercle is distinct, the other three less so, confluent, forming a short sulcus.

#### ELEOTRIS OPHIOCEPHALUS, Kuhl and Van Hasselt.

*Eleotris ophiocephalus*, Cuv. and Val. XII. 239.

Head and back pale brownish black on a golden ground; sides with six parallel longitudinal brown lines; abdomen buff, minutely dotted with brown; dorsals brownish; the posterior and the caudal with indistinct transversal series of brownish spots, and with whitish margins; anal, ventrals and pectorals hemi-transparent, minutely dotted with brown. Iris golden blackish.

D 6— $1/8$ , C  $17\frac{1}{2}$ , A  $1/7$ , V  $1/5$ , P 15, Br. VI.

HABIT.—*Sea of Pinang.*

Java.

TOTAL LENGTH:  $5\frac{1}{2}$  inch.

From *E. porocephala* the present species principally differs in its colours: the head appears a little more elongated, the scales of the crown somewhat larger, and the inferior margin of the preopercle has but a single rather indistinct pore, near the angle of the mouth. It appears to be of rare occurrence at Pinang.

#### ELEOTRIS BUTIS, (Buchan. Ham.)

*Cheilodipterus butis*, Buchan. Ham. 57, 367.

(Icon.) *Cheilodipterus butis*, Gray. Ill. Ind. Zool. II. Pl. 93, Fig. 3

*Eleotris humeralis*, Cuv. and Val. XII. 246.

*Eleotris humeralis*, Bleeker: Verhand. Batav. Gen. XXII. 22, 5.

Reddish brown with dark central spots on some of the scales of the head and sides, and the latter with numerous vermilion spots; the two dorsals brownish at the base, transparent in the middle with



broad vermilion margins; caudal and anal black with vermilion margins; anal rays with similar spots; pectorals transparent; near the root, between the 8th and 16th ray, a large rounded black spot, above and below which a smaller vermilion spot, and a few others at the root of this and the ventral fins. Iris blackish golden.

D 6— $1/8$ , C  $17\frac{1}{4}$ , A  $1/8$ , V  $1/5$ , P 18, Br. VI.\*

HABIT.—*Sea and estuaries of Pinang.*

Estuaries of Bengal, Batavia, Samarang, Surabaya, Pasuruan, West Coast of Madura.

TOTAL LENGTH : 6 inch.

It is readily recognised by the much depressed elongated head, the length of which is contained  $3\frac{1}{2}$  times in the total; the greatest vertical diameter of the body slightly exceeds  $\frac{1}{2}$  of the total length. The opercle is a little pointed above the root of the pectorals, which, however, is less perceptible in the young than in the adult. Although Buchanan Hamilton points out the strong affinity of this species to the Gen. *Gobiomorus*, Lacépède, he was led to consider it a *Cheilodipterus*. His specimen from the Ganges, figured in his unpublished drawings, and later by Mr. Gray, was destitute of the vermilion spots of the body, which vanish in individuals inhabiting muddy estuaries. These spots as also the scarlet margins of the fins, become obliterated after death, when the black spot of the pectoral fins appears surrounded by two smaller yellowish-white ones, as described by M. Valenciennes. (Hist. Nat. des Poiss. XII. p. 186.) It is not numerous at Pinang.

#### ELEOTRIS CAPERATUS, Cantor.

Ground-colours, the vermilion spots of the body and the margins of the fins, the black spots at the root of the pectorals exactly resembling those of *Eleotris butis*.

D 6— $1/8$ , C  $16\frac{1}{4}$ , A  $1/8$ , V  $1/5$ , P 21, Br. VI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH :  $3\frac{1}{2}$  inch.

The crown of the head is apparently scaleless as far as the posterior margin of the orbit; it is depressed, but less elongated than *E. butis*, its length being contained  $4\frac{1}{2}$  times in the total; the opercles expansible and cleft as in *E. butis*. The muzzle is rounded, the gape nearly ver-

\* Buchanan Hamilton gives by mistake 7 branchiostegous rays.

tical, the angle of the mouth opposite the anterior part of the orbit; the lower jaw scarcely longer than the upper; the teeth minute, velvety, the external and internal series of both jaws distant, somewhat longer than the rest; the tongue small, flattened, rounded in front; the eye oval, comparatively larger than in *E. butis*, occupying the second fourth of the head; the distance between both is about one vertical diameter. The upper margin of the orbit forms a sharp arched crest, armed with minute, close, forwards pointing spines; the crest itself is continued obliquely downwards, but becomes spineless in front of the orbit, and there it separates the rostral cavity in which the two nostrils open, from a short crescent-shaped cavity, immediately below the anterior angle of the orbit. Along the upper margin of the somewhat pointed preopercle proceeds a short, but rather deep, horizontal sulcus, which farther follows the tract behind the supraorbital spinous crest. The greatest vertical diameter of the body, at the commencement of the anterior dorsal fin, is a little less than the length of the head. The scales of the opercles, cheeks and the nape are a little smaller than those of the body, which are a little broader than long. The longitudinal series from the root of the pectorals to the caudal contains about 34 scales. The length of the pectoral fins equals that of the head; the other fins, as well as the genital papilla in shape and proportions resemble those organs of *E. butis*. The similarity of colours and their distribution is so striking in both species, that they might be mistaken, but for the supraorbital spinous crest, the sulcated, and comparatively shorter head of *E. caperatus*. Two individuals were observed at Pinang, taken together in stakes with other fishes.

#### SUBFAM. ECHENEIDINÆ.

GEN. ECHENEIS, ([*Artedi*,] *Linne* 1748), *Cuvier* 1817.

With a flattened disk on the head, composed of a certain number of transversal laminæ, directed obliquely backwards, dentated or spiny on their posterior margin, and moveable so that by creating a vacuum between them, or by hooking on by the spines, they are capable of attaching themselves to various bodies, such as rocks, ships, fishes, &c. Body elongated, covered with minute scales; a single soft dorsal opposite to the anal; head perfectly flat above; eyes lateral; mouth horizontally cleft, rounded; lower jaw projecting and as well as the inter-

maxillaries furnished with minute card-like teeth; a regular series of minute teeth like cilia along the margin of the upper maxillaries; branchiostegous rays eight; the stomach is a wide cul-de-sac; cæca six or eight; intestine ample, but short; air-vessel none.

**ECHENEIS NAUCRATES, Linné.**

*Echeneis naucrates*, Linné: Syst. Nat. 1188.

*Echeneis naucrates*, Forskål: Descr. Anim. p. XVI. No. 7.

*Echeneis naucrates*, Bonnat. Encyclop. Method. Ichthyol. Tab. 33.

*Echeneis naucrates*, Bloch. Tab. 171. Fig. 124.

*Echeneis naucrates*, Shaw IV. 209, Pl. 31.

*Echeneis naucrates*, Russell XLIX. Ala Mottah.

*Echeneis naucrates*, Cuv. R. A. (Ed. I.) II. 228.

*Echeneis naucrates*, Bennett: Life of Raffles, 692.

*Echeneis vittata*, Rüppell: N. W. Fische, 82.

*Echeneis naucrates*, Richardson: Report 1845, 203.

*Echeneis naucrates*, Temm. et Schl. Fauna Jap. Tab. CXX. Fig. 1.

Guddimi of the Malays.

(*Adult.*) Disk, fins, and ground-colour of body livid or lead colour of different shades; from the muzzle over the side of the head a broad bluish black band, in some more or less continued along the lateral line; in some the throat and posterior half of the body bluish black; in others livid patches on the sides and abdomen; upper and lower corner of the caudal with a crescent-shaped or triangular milk-white spot. Iris silvery bluish black.

(*Young.*) Of darker colours than the adult; the elevated angles of the dorsal and caudal milk-white as also the angular spots on the trapezoidal caudal.

D 2/33 to 38, C 17½, A 2/33 to 38, V 1/5, P 21 to 23, Br. IX.

Disks 23 to 26.

**HABIT**—*Sea of Pinang, Malayan Peninsula, Singapore.*

Atlantic on both sides, Red Sea, Indian Ocean, Bay of Bengal, Sumatra, Australia, Polynesia, Japan.

**TOTAL LENGTH:** 2 ft. 4 inch.

Single individuals occur at all seasons in the Straits of Malacca. The Malays consider this fish to be powerful manure for fruit trees. (Low: *Dissert. of Pinang*, 179).

## FAM. BLENNIOIDÆ.

## GEN. PETROSCIRTES, Rüppell 1828.

(OMOBRANCHUS, [Ehrenberg,] Cuv. and Val. 1836 —

BLENNECHIS,\* Cuv. and Val. 1836.)

Teeth setaceous, minute, in a single series ; branchial opening very small, placed above the pectoral fins ; dorsal single, with flexible, but not articulated rays ; ventrals thoracic, with three rays.

## PETROSCIRTES VARIABILIS, Cantor.

Head above and back light brownish olive ; sides of the head and body yellowish ; abdomen greenish yellow ; from the orbit to the caudal a longitudinal blackish band, above which the head and body minutely dotted and clouded with black ; dorsal yellowish olive, dotted with black, rays with more or less distinct blackish spots forming two or three longitudinal series ; in some individuals a black spot between the points of the first and second ray ; caudal yellow, base minutely dotted with black and in some with a central black spot ; anal yellow minutely dotted with black, in some with black spots on the rays forming two or three longitudinal series ; ventrals yellow ; pectorals transparent. Iris bright yellow clouded with blackish ; orbital margin olive.

D 11/17 to 20, C 11½, A 17 to 21, V 3, P 15, Br. VI.

HABIT.—*Sea of Pinang, Singapore.*

TOTAL LENGTH : 5 inch.

The form of the body is elongated, gradually compressed from the head to the tail ; the greatest vertical diameter of the body, in front of

\* *Blennechis*, Cuv. and Val.—“ Branchiostegous membrane closed beneath and communicating externally by a small fissure above the base of the pectoral fins ; dentition a modification of that of *Blennius* : lower incisors, attached to the anterior part of the jaw ; on each side a long canine, in some species enormous, reclining ; in others arched, and when the mouth is closed, fitting in a cavity on each side of the palate ; dorsal undivided ; tentacles absent in most.” (Cuv. and Val. XI. 279).—Of the two species of *Petroscirtes*, described by Dr. Rüppell, *P. mitratus* is characterised as having in both jaws a single close series of fine setaceous teeth ; *P. ancylodon* as having in addition two small canines on each side of the upper jaw, and a very long one on each side of the lower. As M. M. Cuvier and Valenciennes admit both species in their Genus *Blennechis*, Dr. Rüppell's *Petroscirtes* claims priority.

the anal, is  $\frac{1}{4}$  of the total ; of which that in front of the caudal is  $\frac{1}{12}$ . The vertical section at the occiput is nearly square, from thence the sides of the head are gradually compressed towards the truncated muzzle, the breadth of which is  $\frac{1}{3}$  less than that of the occiput. The upper part of the head is flattened, gently declining to between the eyes, when it becomes arched and abruptly declining. The length of the head is  $\frac{1}{2}$  of the total, the depth at occiput about  $\frac{1}{3}$  of the length. The distance from the muzzle to the orbit is  $\frac{1}{4}$  of the length of the head. The upper part of the orbit forms a part of the profile ; the diameter of the eye is  $\frac{1}{4}$  of the length of the head. The mouth is rather large : as the jaws are truncated in front, they consist of a central and two lateral portions. The central or transversal supports a single close series of minute setaceous trenchant teeth : those of the upper jaw are placed vertically ; those of the lower, the shorter, horizontally. In the upper jaw their number varies from 30 to 40 ; in the lower from 32 to 50. The number appears to be independent of age : of two individuals measuring 5 inch. in length, one had  $4\frac{2}{3}$ , the other  $3\frac{4}{5}$  incisors, while two others, about 3 inches in length, had  $3\frac{1}{4}$  and  $3\frac{3}{4}$ . On each side of the lateral part of the upper jaw, a short distance behind the incisors, appears a small canine. A much longer canine, equalling the diameter of the eye, is placed on each side of the lower jaw immediately behind the incisors. When the mouth is closed each of the lower canines is received into a large oval cavity in the palate. Behind the canines the jaws are toothless. There is no tongue ; under the throat are two excessively minute filaments. Just above and a little in front of the root of the pectorals appears a short crescent-shaped fissure, the opening of the gills. On the upper part of the head are several pores, of which one above the anterior part of each orbit, appears to be constant. The body appears to be naked with numerous minute pores secreting mucus. The lateral line proceeds from the posterior part of the opercle obliquely upwards to about the fifth dorsal ray, from whence it follows close to the base of the fin towards the eleventh ray, when it turns for a short distance obliquely downwards and suddenly terminates. The dorsal fin commences on a line with the posterior margin of the preopercle ; the first ray is a little shorter than the rest, which are nearly equal,  $\frac{2}{3}$  of the greatest diameter of the body. The dorsal, like all the other fin rays, are undivided, but the first 11 dorsal are simple, not jointed ; the last one is connected

by a triangular membrane to the posterior part of the back. The caudal equals the length of the head; when spread out, the posterior margin is rounded with the points of the rays exposed, but ordinarily the fin appears lanceolate. The anal commences opposite the twelfth dorsal ray; it resembles the dorsal, but the rays are a little shorter; the last one is connected by a membrane to the posterior part of the abdomen. The pectorals are rounded,  $\frac{1}{2}$  of the total length. The ventrals consist of three rays, of which the anterior is the shortest; the central is the broadest, but its length equals the very thin posterior one, which is about  $\frac{1}{2}$  of the total length. Single individuals occur at all seasons at Pinang. They resemble some of the *Gobioidæ* in their power of sustaining life for some time out of water, in their skipping movements, and in their habit of inflating the gill-membrane. The diaphragm is silvery white; the stomach capacious, generally expanded with minute crustacea; the liver small; the gall large, pyriform; the intestinal canal is simple, about the length of the fish; the air-vessel small, pyriform, silvery. This species is closely allied to *P. bankieri*, Richardson,\* which, however, is readily distinguishable by its larger eye ( $\frac{1}{2}$  of the head) and by the third ventral ray being much shorter than the second.

### FAM. LOPHIIDÆ.

GEN. ANTENNARIUS, (*Commerson*) *Lacépède* 1798.

(*CHIRONECTES*,† *Cuvier*, 1817).

Head compressed with three free rays on the crown; mouth vertically cleft; opening of the gills small, round, behind the pectoral fins, in the posterior part of axilla. Tongue toothless. Intermaxillaries, lower jaw, vomer, palatines and pharyngeals with minute card-like teeth. Dorsal fin elongated.

ANTENNARIUS RANINUS, (*Tilesius*).

Klein: *Miss.* III. Pl. 3, Fig. 4?

*Lophius histrio*, Var C., Bloch-Schn., 142?

*Lophius histrio marmoratus*, Bl.-Schn. *Ibid*?

*Lophius raninus*, Tilesius: *Mem. Mosc.* XI. Pl. 16.

\* *Ichthyology of the Voyage of H. M. S. Sulphur*, 136, Pl. LXIV. Fig. 8, 9.  
—*Report* 1845, 266.

† *Chironectes*, Illiger. 1811, a genus of *Marrupialia*.

Lesson: Voy. de la Coquille. Poiss. Pl. 16, Fig. 2.

*Chironectes marmoratus*, Cuv. and Val. XII. 402.

*Chironectes raninus*, Richardson, Rep. 1845, 203.

*Chironectes marmoratus*, Temm. and Schl. Fauna Jap. Pisc. 159,

LXXXI. Fig. 1.

Ground colour of back, sides and fins yellow ochre, largely marbled with blackish brown, in which occur single darker spots; abdomen silvery yellowish-white with brown spots; the cutaneous filaments of the fins and back blackish, those of the sides pale yellow, those of the abdomen white. Iris pale burnished golden with distant radiating brown lines; pupil circular, black.

D 3—12, C 9, A 7, V 5, P 10, Br. VI.

HABIT.—*Sea of Pinang.*

New Guinea, Bombay, Japan.

TOTAL LENGTH:  $4\frac{1}{2}$  inch.

The body is minutely granulated, and the first dorsal ray is excessively slender: it was absent in the larger of two individuals observed at Pinang.

#### ANTENNARIUS HISPIDUS, (Bloch-Schn.)

Koehltreuter, N. C. Petrop. X. Pl. 8, Fig. 1.

*Lophius hispidus* Bloch-Schn. 143, No. 6.

*Lophius striatus*, Shaw, Nat. Misc. V. Pl. 175.

Russell XIX. Kappa Mura Moia.

*Lophius histrio*, Linné, Russell.

*Chironectes lophotes*, Cuvier: Mém. du Mus. III. Pl. 17, Fig. 2.

*Chironectes hispidus*, Cuv. and Val. XII. 407.

Pale reddish yellow (nankin-colour), paler on the abdomen; head and back with transversal sooty brown stripes: those of the nape and back nearly transversal or slightly oblique, radiating obliquely downwards from the eye and from the tail; all the fins except the ventrals spotted with sooty brown; first dorsal ray yellowish alternately brown; the tuft of filaments longitudinally blackish and white; the few short filaments of the body, the lips, tongue, and cavity of the mouth pale yellowish. Iris pale burnished golden with radiating brown lines; pupil black, circular.

D 3—12, C 9, A 7, V 5, P 10, Br. VI.

**HABIT.**—*Sea of Pinang, Singapore.*

*Bay of Bengal.*

**TOTAL LENGTH:** 9 inches.

The body and fins are covered with small, closely set, bipartite spines which rise vertically from the skin. The lateral line is composed of larger somewhat distant spines, each terminating in 6 to 9 points; it commences from the muzzle, proceeds in an arch above the eye and continues following the slope of the back towards the posterior part of the second dorsal. A second, rather indistinct line of distant, larger spines is observed on the upper half of the upper jaw, and a third similar marks externally the posterior margin of the opercle. Here and there on the body, but particularly towards the anterior part of the abdomen, appear some short fleshy filaments. The larger individual was observed at Singapore in May 1840, a second, 4 inches in length, at Pinang in 1845. The stomach is conical, very capacious, occupying the entire length of the lower part of the expansible abdominal cavity; the coats are very thick, leathery; the internal surface with numerous irregular folds. The duodenum, the widest of the intestines, receives the elongated ductus coledochus at a distance of about  $\frac{2}{3}$  inches from pylorus. The length of the intestinal canal is double that of the fish. The liver is very voluminous, elongated; the gall bladder is like a pea, half imbedded in the liver; the spleen very minute. The air-vessel large, oval; the coats very thick.

**ANTENNARIUS COMMERSONI, (Lacépède).**

Renard I. Pl. 43, 212?

*Lophius commersonii*, Lacépède I. 327.

Lacépède I. Pl. 14, Fig. 3?

*Chironectes commersonii*, Cuvier : Mém. du Mus. III. 431, Pl. 18,

Fig. 1.

*Chironectes commersonii*, Cuv. and Val. XII. 426.

Bluish black. On the back, above the lateral line, and in front of the first articulated ray an oblique rose-coloured oval spot, within which a black ring; at the root of the caudal, above and below two similar smaller spots, and one on the side between the pectoral and anal fins. First very slender dorsal ray alternately rose-coloured and black, the tuft of filaments rather full, blackish grey. Rays of the dorsal, anal, pectoral and ventral fins black, the membranes inky with a rather broad sub-marginal rose-coloured band, edged with black.



The points of the ventral rays rose-coloured. The caudal rays black ; between the third and ninth, near the root, the black membrane has a transversal rose-coloured band divided in the middle by a black line. On the posterior part of the caudal a broad sub-marginal rose-coloured band, within which four somewhat undulating black lines, edged with black. Lips, throat, tongue, and cavity of the mouth light bluish gray, dotted with black. Iris rose-coloured silvery, with six radiating black lines, pupil circular, black.

D 3—14, C 9, A 7, V 5, P 9, Br. VI. ?

HABIT.—*Sea of Singapore.*

Isle of France.

TOTAL LENGTH : 5½.

The body and fins are covered with small black spines like those of *A. hispidus*, but there are no fleshy filaments. The lateral line is continued to the root of the caudal fin. The abdomen is very expansible. The present differs from the description given by Cuvier and Valenciennes in the position and number of the rose-coloured spots or ocelli, and the anal fin has one ray less, differences sufficiently insignificant to be considered individual. A single individual was observed at Singapore in May 1840.

GEN. BATRACHUS, Klein 1744.

Head broad ; mouth widely cleft, lips frequently with numerous cutaneous filaments ; anterior dorsal fin very small and almost hid by the integuments ; pectorals supported by flat short arms ; ventrals jugular with three rays of which the anterior is elongated, flattened like a sword-blade ; teeth in the jaws, vomer and palate ; posterior dorsal and the anal extensive, but low ; sub-opercle as large as opercle, both terminating in strong spines ; infraorbitals none ; branchiostegous rays six.

BATRACHUS GRUNNIENS, (Linné).

Seba III. Pl. 28, Fig. 4.

Cottus grunniens, Var. B. Linné : Mus. Ad. Fr. II. 65.

Cottus grunniens, Linné, Var. B : Syst. 1209.

Cottus grunniens, Bloch, Pl. 179.

Cottus grunniens, Lacép. III. 232.

Batrachus, Bloch-Schneider, 42.

Cottus grunniens, Shaw IV. 256.

Batrachus grunniens, Cuv. R. A. II. 253. (\*).

Batrachoides gangene, Buchan. Ham. 34, 365, Pl. XIV. Fig. 8.

*Batrachus grunniens*, Cuv. and Val. XII. 466.

Head above, back and sides light greenish or brownish olive, abdomen greenish or brownish white; head marbled and spotted with black; body with more or less distinct oblique and vertical broad bands, darker than the ground-colour, edged and spotted with black; fleshy filaments buff; fins of the ground-colour of the body, dorsals and anal indistinctly clouded with black or with very oblique blackish bands; caudal, pectorals and ventrals with blackish spots or narrow vertical bands. Iris narrow silvery olive, orbital part blackish.

D 3—22, C 13 $\frac{1}{2}$ , A 18, V 1/2, P 23, Br. VI.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Java, Bombay, Gangetic estuaries.

TOTAL LENGTH: 10 inch.

The length of the head is about  $\frac{1}{2}$  of the total; the transversal diameter of the orbit is  $\frac{1}{2}$  of the length of the head. The eyes are placed nearly horizontally, their distance from the muzzle is one diameter, from each other it is somewhat less than two transversal diameters. The intermaxillary teeth are minute, placed in a double series, which reaches from the symphysis to opposite the eyes. A double series of stronger conical teeth occupies the vomer and palatals, and extends farther back than the intermaxillaries. The lower jaw has a double series of strong conical teeth on the symphysis, but it becomes single in the branches of the jaw. The tongue is bony, small, flattened, elongated and so completely hid in the integuments that it cannot be perceived during life. The opercle terminates in two strong spines of which the superior points obliquely upwards and backwards, the lower is horizontal. The sub-opercle terminates in a single horizontal spine, in length equalling the lower one of the opercle. A number of fleshy filaments terminating in cilia are scattered over the head. One behind each eye, and at the angle of the mouth is longer than the rest. The greatest vertical diameter of the body equals the length of the head. The ventral spine is very short and by a membrane closely joined to the first ray which is the longer and undivided. The second ray is shorter and divided in numerous branches. Single individuals occur, but rarely, at Pinang. The natives attribute poisonous qualities to these fishes, and reject them even as manure. The creaking sound they emit has been noted by Buchanan. They are capable of living a considerable time out of their element.

## FAM. TEUTHIDIDÆ.

## GEN. TEUTHIS, Linné 1766.

(SIGANUS, *Forskål* 1775.—CENTROGASTER, *Houttuyn*.—AMPHACANTHUS, *Bloch-Schneider* 1801.—BURO, [*Commers.*] *Laçépède*, 1803.)

Body oval, compressed; mouth slightly cleft and little protractile; teeth minute, crenulated, in a single series; a horizontal spine in front of the dorsal fin; ventrals with two spines: an external and an internal, between which three rays; branchiostegous rays five, of which the lowest is dilated and hid in the isthmus.

## TEUTHIS JAVA, Linné.

Gronov. Zoophyl. 113, No. 352, Pl. 8, Fig. 4.

Tenthis java, Linné: Syst. 1362.

Russell CII. Worahwah.

Tenthis javus, Cuv. R. A. II. 223, (\*).

Amphacanthus javus, Cuv. and Val. X. 118.

Amphacanthus javus, Schlegel et Müller: Verhand. over de Nat. Gesch. (Amphacanthus) 10.

Amphacanthus javus, Bleeker: Verh. Batav. Gen. XXII. 5.

Ikan kítang of the Malays.

Head above, back and sides dark brownish neutral tint, paler towards abdomen; on the head and back numerous pale bluish grey rounded spots, which on the sides and chest become elongated, irregular, vermiculated; on the abdomen longitudinal and whitish; sides of the head metallic greenish yellow or sulphur-coloured; cheeks washed with brown; pectorals transparent greyish white; rest of the fins pale brownish grey closely dotted with brown, and washed with brown, pale orange and lilac. Iris pale metallic sulphur-coloured; orbital half dark brown or neutral tint.

D 13/10, C 17½, A 7/9, V 1/3/1, P 18, Br. V.

HABIT.—Sea of Malayan Peninsula and Islands.

Sunda, Java, Madura, Coromandel.

TOTAL LENGTH: 11 inch.

The length of the head is a little more than  $\frac{1}{3}$  of the total, in which the depth at occiput is contained  $3\frac{1}{2}$  times. The greatest diameter of the orbit, which is a little oblique and falling beneath the widened

crenulated anterior margin, is  $\frac{1}{2}$  of the length of the head. The greatest vertical diameter of the body is  $2\frac{1}{2}$  in the total length. The horizontal spine in front of the first dorsal has in the young of this and of the following species the point exposed; with age it becomes entirely hid by the integuments. In young individuals the length of the head is from  $4\frac{1}{2}$  to  $4\frac{3}{4}$  in the total; the greatest diameter of the orbit is  $2\frac{3}{4}$  in the length of the head; the greatest vertical diameter of the body is  $2\frac{3}{4}$  in the total length. At Pinang small individuals are numerous at all seasons. As all the species of the present genus are supposed by the Malays of the Straits to be highly poisonous, they are not eaten, but set aside among offal of fish to be used as manure.

**TEUTHIS CONCATENATA, (Cuv. and Val.)**

*Amphacanthus concatenatus*, Cuv. and Val. X. 127.

Kítang of the Malays.

Head above, back and anterior part of the sides above the lateral line blue purple; rest of the sides reddish yellow; abdomen reddish white; back and sides with numerous rounded brick-red spots becoming reddish yellow on the lower part of the sides; sides of the head reddish yellow bronze washed with brown; nostrils, infraorbitals and opercles brimmed with cobalt; pectorals transparent; rest of the fins pale brownish grey, closely dotted with brown, washed with pale reddish yellow and lilac; between the dorsal and anal rays some indistinct brown spots. Iris narrow sulphur-coloured round the pupil; rest brown bronze.

D 13/10, C 17 $\frac{1}{2}$ , A 7/9, V 1/3/1, P 17, Br. V.

HABIT.—*Sea of Pinang.*

Isle of Buru, Batavia.

TOTAL LENGTH: 6 $\frac{1}{2}$  inch.

The length of the head is  $4\frac{1}{2}$  in the total, the depth at occiput  $3\frac{1}{2}$ . The greatest oblique diameter of the orbit is  $2\frac{1}{2}$  in the length of the head. The outline of the head is convex, particularly between the eyes. The greatest vertical diameter of the body is  $2\frac{1}{2}$  in the total length. When the caudal fin is spread out, the posterior margin is nearly straight. Single individuals occur at Pinang at all seasons.

## TRUTHIS DORSALIS, (Cuv. and Val.)

*Amphacanthus dorsalis*, Cuv. and Val. X. 143.

*Amphacanthus dorsalis*, Schlegel and Müller: l. c. 10, 13, Tab. 2,  
Fig. 1.

Kítang of the Malays.

Head above and back pale brownish olive, lighter on the upper half of the sides; lower half and abdomen bluish white; immediately beneath the origin of the lateral line and in front of the pectorals pale reddish lilac; back and sides with numerous small oval bluish white spots; cheeks and opercles pale metallic sulphur-coloured, opercles edged with pale lilac; pectorals transparent; caudal pale brownish olive, minutely dotted with brown; rest of the fins greyish white, tinged with lilac, minutely dotted with brown. Iris yellowish white, orbital margin olive.

D 13/10, C 17½, A 7/9, V 1/3/1, P 16, Br. V.

HABIT.—*Sea of Pinang.*

Batavia.

TOTAL LENGTH: 6 inch.

The length of the head is  $4\frac{1}{2}$  in the total. The greatest, oblique, diameter of the orbit is  $\frac{1}{2}$  of the length of the head. The greatest vertical diameter of the body is  $\frac{1}{2}$  of the total length. At Pinang this species is numerous at all seasons.

GEN. ACANTHURUS, *Forskål* 1775.

(HARPURUS, *Forster* 1778.—ASPIDURUS, *Lacép.* 1802.)

Tail on each side armed with a strong moveable spine; head and body compressed; eyes elevated; mouth slightly cleft; teeth in a single series, trenchant, with crenulated margins; dorsal single; body covered with minute scales; branchiostegous rays five.

ACANTHURUS XANTHOPTERUS, Cuv. and Val.

Plate IV.

*Acanthurus xanthopterus*, Cuv. and Val. X. 215.

*Young.* Head and body violet brown, paler towards abdomen; the nostrils opening in a bright gamboge triangular spot, resting behind on the anterior half of the orbit, the apex towards the middle of the

profile; dorsal fin bright yellow, minutely dotted with brown; along the base a cobalt blue longitudinal band, above which a second parallel lilac one terminating on the anterior third of the fin; a third and a fourth above each other: both bifurcating about the anterior half; upper margin black; anterior half of caudal white, the rest brown like the body; posterior margin broad, black; anal bright yellow minutely dotted with brown, with a cobalt blue basal band, above which four parallel lilac ones, external margin black; ventral spine and rays pale bluish black; membrane pale grey minutely dotted with brown; pectoral rays yellow, membrane transparent. Iris narrow, yellow round the pupil, next broad silvery white, orbital margin reddish brown.

D 9/27, C 17½, A 3/25, V 1/5, P 17, Br. V.

HABIT.—*Sea of Pinang.*

Seychelles.

TOTAL LENGTH: 5¼ inch.

The length of the head is 4½ in the total; the diameter of the eye is 3½ in the length of the head. The preopercle, opercle, scapular and humeral bones are distinctly radiated. In each jaw is a single series of 16 trenchant teeth: those of the upper appear somewhat larger and their margin has from 10 to 12 crenulations (Fig. 3. Magnif.); in the lower jaw the pair of teeth on the symphysis is longer than the rest, and the whole of the margin carries 10 crenulations; all the rest are shorter, truncated with about 5 crenulations. The greatest vertical diameter of the body (Fig. 2.) is 2½ in the total length. The whole of the head and body, the anterior half of the caudal and the base of the dorsal and anal fins, are covered with small elongated oval scales (Fig. 4. Magnif.), of which those of the body have the posterior part truncated with about 12 unequal cilia on the margin. The lateral line appears like a thread at the upper fifth of the body; it is slightly undulating, following the outline of the back, which is less arched than that of the abdomen, till it arrives between the terminations of the dorsal and anal fins. From thence it is at first a little downwards arched and then rises, so as to pass above the spine of the tail towards the caudal. Above and below the lateral line appear a number of short, excessively minute, backwards directed tubes. The length of the spine is less than the diameter of the eye; the anterior margin is sharp, the posterior rounded. The posterior margin of the caudal is slightly concave; the superior

lobe a little longer than the inferior. The stomach is short, thick, gizzard-like; the gall very large. There are four cæcopyloric appendages. The intestinal canal is spirally folded, more than twice the length of the fish. A single young individual was observed at Pinang in March 1845. The fishermen asserted that it is of rare occurrence, and attains to a foot in length.

### FAM. AULOSTOMATIDÆ.

#### GEN. CANNORYNCHUS,\* Cantor.

(Equivalent to FISTULARIA, Linné, 1766).

Mouth tubular, elongated, depressed; jaws slightly cleft, nearly horizontal, with small teeth; head elongated from  $\frac{1}{3}$  to  $\frac{1}{2}$  of the total length; body elongated depressed; scales invisible; behind the head, above and below, some bony appendages casing the anterior part of the head, dorsal fin single, and as well as the anal composed of undivided rays; branchiostegous rays seven.

#### CANNORYNCHUS IMMACULATUS, (Commerson.)

Russell, CLXXIII. Goorum.—*Fistularia tabacaria*, Lin.

*Fistularia tabaccaria*, White, Voyage Bot. Bay. P. 296, Fig. 2.

*Fistularia immaculata*, (Commerson,) Cuv. R. A. II. 267.(')

*Fistularia commersonii*, Rüppell: Neue Wirbelth. Fische, 142.

*Fistularia immaculata*, Richardson, Rep. 1845, 247.

*Young.* Head above light greenish grey; upper half of opercles greenish olive minutely dotted with black, lower half as well as the under surface of the head and the abdomen whitish; sides of the body light slate grey; the lateral line bordered beneath by a pale silvery bluish white line; fins greenish hyaline; caudal filament brownish olive. Iris narrow golden round the pupil; the rest blackish silvery.

D 15, 16 or 17, C 13 $\frac{1}{2}$ , A 14 or 15, V 1 $\frac{1}{5}$ , P 15, Br. VII.

HABIT.—*Sea of Pinang.*

Indian Ocean, Coromandel, Mohila, (Red Sea.)

|                                          |       |                       |
|------------------------------------------|-------|-----------------------|
| Length of the head : .....               | 0 ft. | 5 $\frac{1}{2}$ inch. |
| „ „ „ body to the root of caudal fin, .. | 0 „   | 8 $\frac{1}{2}$ „     |
| „ „ „ caudal filament, .....             | 0 „   | 4 $\frac{1}{4}$ „     |

TOTAL LENGTH : 1 ft. 6 $\frac{1}{2}$  inch.

\* *Kávon*, red; *πόρυχος*, snout. Substituted for *Fistularia*, Linné, 1766, pre-occupied by *Fistularia*, Donati, 1750. (*Polypi*.)

The length of the head is  $\frac{1}{2}$  of the length of the body, measured from the symphysis of the lower jaw to the point of the caudal fin. The tubular mouth, to the anterior margin of the orbit, is  $2\frac{1}{2}$  times longer than the rest of the head. The horizontal diameter of the eye is  $9\frac{1}{2}$  in the length of the head; the distance of the eyes across the forehead is  $\frac{1}{2}$  of the diameter; the narrow forehead is widened by a transparent membrane extending along the upper margin of the orbit, and giving it an elongated oval shape. From the sides of the occiput proceeds a sharp crest of minute spines to the preopercle; the posterior and anterior part of the orbit are finely toothed, and the latter part has a short broad spine above and below. On each side of the tubular mouth, appears a sharp ridge, the posterior half of which is armed with small forwards directed spines. The lower jaw is longer than the upper, with a round protuberance at the symphysis. Both jaws have a single series of small, somewhat unequal, reclining teeth. A similar single series appears on each of the palatals, and from four to six on the anterior part of the vomer. Between the intermaxillary series of teeth and those of the vomer is extended a small crescent-shaped membrane. From the centre of the opercle proceed downwards two strong strisæ and numerous finer ones radiate backwards. From the posterior part of the orbit radiate a number of lines backwards. Immediately behind the occiput commence a pair of elongated lanceolate bony plates, each contained about  $5\frac{1}{2}$  times in the length of the body, forming in the middle of the back a slightly raised line. Behind the pectoral fins appears a shorter lanceolate bony plate, the upper margin of which joins the former pair of the back; the lower joins a larger also lanceolate plate, which on each side covers the anterior part of the abdomen. The latter pair of abdominal plates are turned up at the sides at a right angle; their lower surface is honeycombed and the anterior half of their lower margin leaves a central open space on the abdominal surface. The length of the pair of abdominal plates is  $\frac{2}{3}$  of the dorsal. The length of the pectoral fins and the lobes of the caudal equal the horizontal diameter of the eye. The vertical diameter at occiput, as well as the greatest diameter of the body, is  $\frac{2}{3}$  of the horizontal diameter of the eye. The breadth across the occiput equals the latter diameter. A vertical section of the head is broad rectangular; one of the anterior part of the body, in front of the dorsal, is nearly triangular; behind the



dorsal it is rhombic. The dorsal and anal fins commence opposite each other at the posterior fourth of the distance from the anterior part of the orbit to the point of the caudal lobes. The lateral line commences above the opercle; the anterior part, occupying the dorsal plates, is arched with the convexity towards the centre of the back, so that the lines of both sides describe the figure of an elongated hour-glass. At the termination of the lateral pair of bony plates the lateral line commences, following the centre of the side, above the bluish white line. The lateral line consists of a number of a linear tubes, deeply cleft at both ends; behind the dorsal fin the tubes change to very short, sharp bony ridges, which to the touch appear like spines. The ventral fins are very short situated in the centre between the muzzle and the point of the caudal lobes. The length of the elongated central caudal ray appears to be proportionally longer in the very young individuals; in the largest it was divided in two. Four individuals were observed at different seasons at Pinang;\* they were examined sometime after death, and none of them exhibited the lateral series of blue spots noted by Dr. Rüppell.

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## ORDO ANACANTHINI.

### FAM. PLEURONECTISIDÆ.

#### GEN. PLATESSA, Cuvier, 1817.

In each jaw a series of trenchant, obtuse teeth; frequently on the pharyngeals teeth like paving-stones; dorsal extending in front to above the upper eye, leaving, as well as the anal, a naked interval between themselves and the caudal; shape rhomboidal; most species have the eyes on the right† side; two or three small cæca.

#### *Eyes and colour on the left side.*

\* Another species of the present family: *Amphisyle scutata*, Klein, was observed in great numbers at Singapore in May 1840. From 1842 to 1845 none occurred at Pinang, nor were the fishermen there acquainted with the fish.

† The terms *right* and *left*, or *dextral* and *sinistral* are applied to the species of this family, as to those of every other, while the fish is placed with the tail towards the observer, the dorsal fin upwards, and the anal downwards.

## PLATESSA RUSSELLI.

(Icon.) *Platessa russelli*, Gray : Ill. Ind. Zool. Pl. 94, Fig. 2.  
Ikan Siblah of the Malays.

*Left side.* Pale reddish- or yellowish-brown ; each scale with a vertical buff spot close to the dark brown posterior margin ; opercle and anterior third of abdomen pale bluish or neutral tint. Iris silvery, coloured like the body.

*Right side.* Buff or dust-coloured ; opercle and anterior third of abdomen pale bluish. Fins transparent, coloured like the body, but paler, minutely dotted with brown ; dorsal, caudal and anal with a few scattered indistinct brownish spots.

D 70 to 73, C 15 $\frac{1}{2}$ , A 56, V 6, P 12, Br. VII.

HABIT : *Sea of Pinang, Malayan Peninsula, Singapore.*

TOTAL LENGTH : 1 ft. 1 inch.

*Left side.* The length of the head is  $4\frac{1}{2}$  in the total. The upper orbit occupies the second-fourth of the head, close to the profile of the back without encroaching upon it ; it is oval ; the horizontal diameter, being  $\frac{1}{4}$  of the length of the head, exceeds by  $\frac{1}{2}$  that of the lower rounded orbit. Both are separated by a very narrow sharp ridge. The vertical distance from the centre of the inferior orbital margin of the lower eye to the margin of the lower jaw is  $\frac{1}{2}$  of the length of the head. The posterior apertures of both nostrils are situated immediately in front of the orbits ; they are rounded and larger than the anterior ones. Of the latter the upper one appears to be a small puncture about midway in front between both orbits. The lower anterior aperture is situated obliquely in front of the posterior, close to the margin of the left upper maxillary. The latter bone is narrow, widened and obliquely truncated at the lower extremity. The angle of the mouth scarcely extends to the anterior part of the orbits. The margin of the mouth is exclusively formed by the elongated intermaxillaries, to which are confined the teeth. The latter are conical, blunt, slightly inwards arched and placed in a single series, of which the anterior four or five of each side are a little larger and more distant than the rest, which are minute and placed closely together. The teeth of the lower jaw are longer, fewer, and all with intervals. The tongue is linear, smooth. The opercles and cheeks are hid by scales. The form of the body is

oblong, the greatest vertical diameter, at the second-third of the total length, slightly exceeds  $\frac{1}{3}$  of the total. The body is covered by upwards of 67 longitudinal series of scales, of which there are about 81 on a line between the gill-opening and the caudal. The scales are small rounded with about 15 radiating lines at the radical part; the posterior margin is closely ciliated. The lateral line consists of simple tubes. It commences at the lower margin of the lower orbit, ascends in the shape of the letter S to the upper extremity of the preopercle, then slightly descends to above the posterior angle of the opercle, when it suddenly rises describing a short arch, terminating above the point of the pectoral. From thence it proceeds straight along the middle of the side to the point of the posterior margin of the caudal fin. The dorsal fin commences opposite the anterior angle of the upper orbit; the distance from the muzzle equals the horizontal diameter of the upper eye. All the rays, except the three last ones, are undivided, and with a single series of small scales along the anterior margin; the points of the rays project a little beyond the membrane, so as to give the fin a fringed appearance. The longest rays are contained  $2\frac{1}{2}$  times in the length of the head: they are situated at the commencement of the posterior half of the fin, the distance of which from the caudal is  $\frac{1}{2}$  of that of the anterior ray from the muzzle. The root of the caudal is covered with small scales; the posterior margin is pointed in the centre, the two rays of which are the longest,  $\frac{2}{3}$  of the head. The posterior four or five anal rays are divided; the rest are simple and resemble the dorsal. The extent of the base of the anal is about  $\frac{1}{4}$  less than that of the dorsal. The left ventral is situated a little nearer the gill-opening than the anal; the two first rays are undivided; the second, the longest, is  $\frac{1}{3}$  of the head, and extends to the second anal ray. The right ventral is a little farther back, the first ray commencing opposite the third ray of the left fin. The two upper pectoral rays are undivided; the third, the longest, slightly exceeds  $\frac{1}{2}$  of the head. Single individuals occur at Pinang, at all seasons. They are eaten by the natives.

GEN. HIPPOGLOSSUS, Cuvier, 1817.

Fins resembling those of *Platessa*; form generally more elongated; jaws and pharynx with teeth, in most species strong and sharp.

*A.—Eyes and colour on the right side.***HIPPOGLOSSUS ERUMEI, (Bloch-Schneider.)**

Pleuronectes erumei, Bloch-Schneider.

Russell, LXIX. Adalah.

Hippoglossus erumei, Cuv. R. A. II. 340.(?).

Hippoglossus erumei, Rüppell : Atlas, 121.

Hippoglossus erumei, Rüppell : Neue Wirbelth, Fische, 84.

Ikan Siblah of the Malays.

*Right side.* Dull brownish- or greenish-grey ; anterior third of dorsal milk-white, minutely dotted with brown ; rest pale bluish brown, dotted with brown and washed with black ; caudal blackish with a broad, vertical, whitish band at the base ; anterior eighth of anal milk-white, rest like dorsal ; pectorals and ventrals hyaline, the latter minutely dotted with brown. Iris silvery, sending a number of vermicular diverging threads over the circular black pupil.

*Left side.* Brownish white, minutely dotted with brown.

D 48 to 53, C 15½, A 35 to 39, V 6, P 14 or 15, Br. VII.

HABIT : *Sea of Pinang, Malayan Peninsula.*

Coromandal, Bay of Bengal, Estuaries of the Ganges,  
Massamb.

TOTAL LENGTH : 1 ft.

*Right side.* The length of the head is  $\frac{1}{4}$  of the total. The upper orbit is placed horizontally on the upper surface of the head ; its distance from the muzzle is  $\frac{2}{3}$  of its longitudinal diameter, which is  $\frac{1}{4}$  of the length of the head. A little below, and in front of the upper orbit, on the left side of the muzzle, appears the posterior circular aperture of the left nostril ; the anterior one is smaller, tubular and situated a little in front of the posterior. The right orbit is slightly shorter than the left, and is situated vertically on the left side of the head, bordering upon the upper maxillary. The circular pupils are protected by a number of vermicular silvery filaments which diverge from the upper margin of the iris. The distance between both orbits scarcely exceeds  $\frac{1}{4}$  of their diameter ; each orbital margin is a little raised with a narrow intervening furrow. The apertures of the right nostril are situated immediately in front of the right eye, and resemble the corresponding of the left. The upper maxillary is elongated, widened and truncated

bowel. The linear elongated intermaxillaries form the margin of the mouth, and have two series of long, distant, arched teeth, each with a minute barb on the posterior part of the point. The teeth of the external series are fixed, but those of the internal are moveable, and may be laid down like those of *Saurus nehercus*, (Buchan. Hamilton). The teeth of the lower jaw resemble those of the upper, but they are more numerous; those of the inner series are a little longer, and those near the symphysis have an indistinct double barb. On each side of the palate appears a single series of small pointed teeth, and in young individuals, upwards of 4 inches in length, four to six similar on the vomer, which, however, very early disappear. The tongue is minute and smooth; on each side of the root rises a small cluster of minute pointed teeth, and similar appear at intervals on the rest of the hyoid. The angle of the mouth is situated opposite the posterior part of the left orbit. The greatest vertical diameter of the body, at the second third of the total length, slightly exceeds  $\frac{1}{4}$  of the latter. The lateral line commences at the inferior margin of the lower eye, which it follows, and turning backwards over the upper margin of the opercle, it describes a low arch which terminates opposite the middle of the dorsal. From thence it proceeds straight along the middle, to the point of the posterior margin of the caudal. The line is a little raised, and is on each scale composed of three small tubes: a central, from which an upper and lower diverge backwards. The greatest vertical diameter contains from 55 to 57 series of scales; the lateral line, from the opercle to the root of the caudal, 69 to 71 scales. The scales are small rounded, with 12 to 15 radiating lines at the radical portion and indistinctly ciliated in the centre of the posterior margin. The dorsal fin commences behind the upper orbit at a distance of one longitudinal diameter, and terminates at an equal distance from the caudal. The 9 or 10 anterior rays are undivided; the longest, towards the middle of the fin, are  $2\frac{1}{2}$  in the length of the head; all have at their anterior margin a series of small scales. The anal is  $\frac{1}{2}$  shorter than the dorsal; the two first rays are undivided; in other respects it resembles the dorsal. The root of the caudal is scaly; the posterior margin is bluntly pointed in the centre, the two rays of which, the longest, are  $\frac{2}{3}$  of the head. The right ventral is situated a little in front of the pectoral, much nearer the gill-opening than the first anal ray; the two

first rays are undivided ; the fourth, the longest, is  $2\frac{1}{2}$  in the length of the head. The left ventral is placed a little farther backward. The pectorals are pointed,  $\frac{1}{2}$  the length of the head. The stomach is very capacious, broad pyriform ; the intestinal canal is simple, about  $\frac{1}{2}$  of the total length. Single individuals occur at all seasons at Pinang, and are eaten by the natives.

*B.—Eyes and colour on the left side.*

#### HIPPOGLOSSUS ERUMEI, VAR. A.

**HABIT:** *Sea of Pinaag.*

This is simply a *reversed, sinistral variety*, necessary, however, to distinguish as such from a second, differing in colours. The present attains to the size of the dextral, but at Pinang it is of rarer occurrence. Individuals of equal length differ in no characters except in such as are necessarily the consequence of *reversion*, such, for instance, as the left ventral fin being placed a little anterior to the right.

#### HIPPOGLOSSUS ERUMEI, VAR. B.

Russell, LXXVII. Nooree Nalaka C.

Hippoglossus nalaka, Cuvier, R. A. II. 340(?).

*Left side.* Ground colour pale brownish grey or white minutely dotted with brown ; a broad brownish black vertical band, extending from the jaws over the sides of the head and body to the root of the pectorals ; two similar on the sides of the body, and a fourth over the posterior part of the body and the tail ; the three last bands extending faintly over the corresponding parts of the dorsal and anal ; anterior half of caudal whitish dotted with brown ; posterior half brownish black ; rest of the fins and eyes like *H. erumei*.

*Right side*, like the *left* of *H. erumei*.

**HABIT:** *Sea of Pinang, Malayan Peninsula, Singapore.*

Coromandel.

Except in colours and being sinistral, the present variety agrees in every other character with *H. erumei*. Russell, indeed, observed the strong resemblance, but he imagined that in this variety the scales were smaller, and the lateral line carinated. Comparison of equal individuals of both shews no difference of the size of the scales, and the lateral line is equally raised in both. Russell describes the length as

being six inches. Of a number of individuals examined at Pinang and Singapore none exceeded  $6\frac{1}{4}$  inches. It remains to be ascertained if this variety attains to the same size as *Var. A.*, or if it is merely a transient livery of certain young individuals of *Var. A.*

GEN. *SOLEA*, Klein 1748.

Eyes and colour on the right side; mouth distorted on the side opposite the eyes; minute crowded teeth in the half of both jaws opposite the eyes, the other half toothless; form of the body oblong; muzzle rounded and generally projecting beyond the mouth; dorsal commencing opposite or a little in front of the upper eye; caudal separated from dorsal and anal.

*SOLEA HUMILIS*, Cantor.

*Right side.* Pale umber-brown, minutely dotted with black, and with numerous small blackish spots; an indistinct larger one close below the middle of the base of the dorsal, and a second at the posterior third; two corresponding spots near the base of the anal; membranes of the fins pale brownish buff dotted with black, rays pale umber; on the caudal some indistinct blackish spots; near the point of the pectoral an oval-, and between the two lowest rays a linear black spot. Iris pale silvery.

*Left side.* Pectoral, ventral and short filaments about the mouth brownish white.

D 57, C 124, A 42, V 5, P 8, Br. VI.

HABIT: *Sea of Pinang.*

TOTAL LENGTH:  $3\frac{1}{2}$  inch.

*Right side.* The form of the body resembles that of *Solea pegusa*, Yarrell,\* but the vertical diameter is greater in the present. The length of the head is  $5\frac{1}{2}$  in the total. The upper orbit, the larger, is situated in the centre between the angle of the mouth and the corresponding part of the dorsal, but much nearer the muzzle; the horizontal diameter is  $\frac{1}{2}$  of the length of the head. The lower orbit is situated between the angle of the mouth and the posterior angle of the upper orbit, of which its horizontal diameter is  $\frac{2}{3}$ . The distance between the orbits slightly exceeds the horizontal diameter of the upper orbit.

\* Zool. Journ. IV, 467, Pl. 16.—British Fishes: II, 260.

The whole of the head is covered with little scales like those of the body, rough to the touch. The tongue is minute, smooth, truncated triangular. The greatest vertical diameter of the body, at the end of the anterior third of the dorsal, is  $2\frac{1}{2}$  in the total length. On the diameter may be counted 69 series of scales. The slightly raised lateral line continues straight from behind the upper part of the opercle to the caudal, a little nearer the back than the abdomen. It contains 85 scales, each with a minute central tube. The scales of the head and body are small, elongated tetragonal, the posterior margin rounded. On the radical part appear about nine radiating lines, some of which are divided in two; the centre of the posterior margin has upwards of thirteen cilia, although very fine, yet sufficiently strong to make the scales appear rough to the touch. The first dorsal ray commences on a level with the anterior angle of the upper orbit. The first nine rays are undivided; all are covered by an elongated pyramidal sheath of scales, consisting of two or three series, which extend to near the points of the rays, which project beyond the membrane. The longest rays, towards the middle of the fin, equal  $\frac{1}{2}$  the length of the head. The anal resembles the dorsal, but has only the four anterior rays undivided. The caudal is rounded, equal the length of the head. The pectoral is pointed,  $\frac{1}{2}$  the length of the head. The right ventral is very small, about  $\frac{1}{2}$  of the pectoral, and the last ray is connected by a membrane to the first anal.

*Left side.* A little above and behind the symphysis of the upper jaw appears a small tubercle, through which is pierced a single minute nostril. The base of the dorsal as far as the nine first rays carries a few short soft filaments, some of which are scattered over the side of the head; they become more numerous and crowded towards the left angle of the mouth. This side of the jaws resembles the cipher 3, there being at the angle a small pointed tubercle, directed inward. The teeth are very fine, crowded and hid to the point in the fleshy lips. The left ventral is longer than the right and not joined to the anal. A single individual was observed at Pinang in October 1842.

SOLEA OVATA, Richardson.

*Solea ovata*, Richardson : Report, 1845, 279.

*Right side.* Brownish ash-grey, minutely mottled with pale black.



ish, towards the base of the dorsal and anal three rounded, distant, black spots, edged with light grey; on the rest of the body a few scattered similar spots, also indistinctly ocellated; pectoral greyish at the base rest black; rest of the fins pale ash-grey minutely mottled with blackish. Pupil horizontally oval; iris pale silvery round the pupil; the rest ash-grey.

*Left side.* Brownish white; opercles and abdomen lead grey; filaments about the head white; fins buff.

D 65, C 12½, A 48, V 5, P 9, Br. VI.

HABIT: *Sea of Pinang.*

China Seas, Canton.

TOTAL LENGTH: 3½ inch.

*Right side.* The length of the head is  $\frac{1}{4}$  of the total. Both eyes are nearly equal,  $\frac{1}{4}$  of the length of the head; the upper one occupies the second-fifth; the lower is removed slightly farther back, and touches the upper lip; the posterior angle of both eyes are situated a little farther back than the angle of the mouth, the eyes are separated by a sharp rest, the diameter of which is scarcely  $\frac{1}{4}$  of the horizontal diameter of each eye. The tongue and teeth resemble those organs of *S. leuiscus*. The greatest vertical diameter of the body, at about the middle of the dorsal is  $2\frac{1}{2}$  in the total length. On the diameter may be counted about 76 scales. The latter are rough to the touch; on the radical part appear upwards of 16 radiating lines, some of which are divided in two; the centre of the posterior margin is armed with from 9 to 12 fine spines. The lateral line proceeds straight in the middle of the side from the gill-opening to the caudal; it contains upwards of 95 scales, each with a minute central tube. The first dorsal ray commences opposite the anterior angle of the upper eye; the longest rays, towards the middle of the fin slightly exceed  $\frac{1}{4}$  of the length of the head. The anal resembles the dorsal. The rounded caudal is distinct, but united by a membrane to the dorsal and anal; its length is  $\frac{1}{4}$  of the head. The pectoral is elongated  $\frac{1}{4}$  of the length of the head. The ventrals are nearly equal, about  $\frac{1}{4}$  of the length of the head.

*Left side.* Numerous filaments appear on the lower lip and the lower margin of the gill-cover. The left pectoral is but  $\frac{1}{4}$  of the right. Single individuals occur at Pinang at all seasons.

## SUB GEN. SYNAPTURA,\* Cantor.

(BRACHYURUS, Swainson, 1839.)

General structure of *Solea*, but the caudal, dorsal and anal fins are all united.

## SYNAPTURA COMMERSONIANA, (Lacépède.)

Pleuronecte commersonien, Lacép. III. Pl. 12, Fig. 2, (not IV. Russell, LXX. Jerree Potoo A. 656.)

*Solea commersoniana*, Cuvier, R. A. II. 343.(').

*Brachirus commersonii*, Swainson, II. 303.

Ikan lédah† of the Malays.

*Right side.* Greenish or brownish olive, darkest on the opercles, minutely dotted with brown; all the scales with a small vertical buff spot behind the cilia, giving a dusty appearance to the ground colour; pectoral black with buff margin; rest of the fins like the body but lighter; dorsal, caudal and anal with a narrow milkwhite edge within which a second sooty brown, composed by a series of single spots on the membranes; lips and pointed papillæ of the lower olive; mouth and opercles inside pale olive, closely dotted with black. Iris a silvery or golden green ring; the rest bluish black.

*Left side.* Pectoral and ventral buff.

D 78 or 81.

C 12, *Right* V 5, *Left* V 4, P 6, Br. VI.

A 65 or 66,

155 or 159

HABIT: *Sea of Pinang, Malayan Peninsula, Singapore.*

Coromandel.

TOTAL LENGTH: 8½ inch.

*Right side.* The length of the head is ¼ of the total. The upper orbit is situated above the middle of the right upper lip at equal distance from the angle of the mouth and the muzzle; the greatest diameter is oblique, upwards and backwards is ½ of the length of the

\* Συναπτός, joined; οὐρά, tail. Substituted for *Brachirus*, properly written: *Brachyurus*, Swainson 1839, preoccupied by *Brachyurus*, Fischer, 1814. (*Mammalia*.)

† Lédah, tongue.

head. From the anterior angle of the upper orbit proceeds a short bony ridge which terminates close to the muzzle in a flat rounded point, which with the muzzle produces a short furrow. The lower orbit is situated immediately above the angle of the mouth, a little posterior to the upper one, and in a different position. The greatest diameter is oblique, downwards and backwards, scarcely shorter than that of the upper orbit. The distance between the anterior angles of both orbits equals their greatest diameter. The posterior aperture of the nostril is a little in front of the lower orbit; the anterior is a little farther in front, tubular or pierced through a small papilla. The lower right lip is fleshy with numerous pointed papillæ. The tongue is minute, linear, smooth. The teeth resemble those of *Solea humilis*. All the scales of the head, below the level of the upper eye are a little larger than those of the body; above that level, towards the origin of the lateral line, they are nearly double the size, and by far the greatest of all. The form of all is nearly rectangular, with the posterior margin rounded, with 8 or 9 fine spines, which make the scales rough to the touch. At the radical part appear 3 or 4 radiating lines. The greatest vertical diameter of the body, at the commencement of the second third of the back, is  $\frac{1}{4}$  of the total length. This diameter contains about 71 series of scales. The lateral line commences behind the upper part of the opercle and proceeds straight, a little nearer the back than the abdomen, to the caudal. It consists of about 167 minute central tubes. The first dorsal ray commences close to the muzzle, a little below the level of the anterior margin of the upper orbit. The rays, of which the first four are undivided, gradually increase in length to the last which is  $\frac{1}{2}$  of the length of the head. The caudal is elongated, terminating in a rounded point,  $\frac{2}{3}$  of the length of the head. The anal, all the rays of which are divided, commences beneath the posterior part of the interopercle, between the two ventrals. The basal half of all three vertical fins are covered with minute scales, and the points of the rays project a little beyond the membrane. They are so closely connected, that the milkwhite outer margin is uninterrupted, and the shape of the fish resembles a broad point of a lance. The length of the pectorals is  $\frac{1}{4}$  of the head. The ventrals are situated immediately in front of the anal, but on a little higher level; their length equals the pectorals. On

the left side about the lower lip and the throat appear a number of short white filaments. The figure of Russell (LXX.) is incorrect. The short arch above the upper eye is not produced by the lateral line, but by a bony ridge, and the caudal fin is too short and rounded, and distinct. His original was probably mutilated. Single individuals are of rather rare occurrence at Pinang.

### SYNAPTURA ZEBRA, (Bloch.)

*Pleuronectes zebra*, Bloch, Tab. 187.

*Pleuronectes zebra*, Linné: Syst. 1226.

*Pleuronectes zebra*, Shaw, IV. 305, Pl. 44.

*Solea zebra*, Cuvier, R. A. II. 343 (!)

*Pleuronectes zebra*, Bennett: Life of Raffles, 692.

*Brachirus zebra*, Swainson, II. 303.

*Right side.* Ground colour of head, body, dorsal, anal and ventral fins reddish white minutely dotted with brown; on the head and body upwards of 19 vertical sooty- or blackish-brown bands extending over the dorsal and anal; the bands double or in pairs, frequently confluent towards the tail; a reddish yellow or pale orange band over the root of the caudal and the last dorsal and anal rays; rest of the caudal black with several oval milkwhite spots; pectoral black; pupil iridescent, circular; iris pale golden, with four radiating blackish bars.

*Left side.* Pectoral, ventral and filaments of the mouth and throat reddish white; opercle and abdomen bluish.

D 81 or 83.

C 16, *Right V 5, Left V 4, P 7 or 8, Br. VI.*

A 67 or 65

164

*HABIT: Sea of Malayan, Peninsula and Islands.*

Chusan, Macao, Bay of Bengal, Sumatra.

*TOTAL LENGTH: 7 inch.*

*Right side.* The length of the head is  $\frac{1}{2}$  of the total. The upper orbit is situated above the middle of the upper right lip, at equal distance from the muzzle and the angle of the mouth; the horizontal diameter is  $\frac{1}{2}$  of the length of the head. The lower orbit is a little farther backwards, immediately above and behind the angle of the

mouth: the horizontal diameter equals that of the upper; the distance between both is somewhat less. A slight downwards arched ridge proceeds from the anterior angle of the upper orbit to the muzzle. The nostrils, mouth and teeth resemble those of *S. commersoniana*, but the lower right lip presents no papillæ. The greatest vertical diameter, at the end of the anterior third of the body, is  $3\frac{1}{2}$  in the total length; it contains upwards of 71 series of scales. The latter are all small, nearly rectangular, with 7 to 9 radiating lines at the radical part, and with as many spines at the posterior rounded margin. The lateral line in its course resembles that of *S. commersoniana*; it consists of upwards of 121 small central tubes. The dorsal commences opposite the anterior angle of the upper orbit, at a distance from the upper lip of  $\frac{1}{3}$  of the length of the head, but not immediately from the upper lip, as represented by Bloch, and the copies of his incorrect figure. The anterior 26 to 28 rays are undivided; the last rays are the longest and as well as the caudal and the last anal rays slightly exceed the length of the head. The caudal is broader and more rounded than in *S. commersoniana*, which in other respects the three united fins resemble. The pectoral is very pointed owing to the second upper ray being much longer than the rest, although it is but  $2\frac{1}{2}$  in the length of the head. The length of the ventrals is about  $\frac{1}{2}$  of the length of the head; they are placed as in *S. commersoniana*, but the distance from the first anal ray is a little greater. Single individuals occur at Pinang at all seasons.

GEN. ACHIRUS, Lacépède, 1802.

Resembling *Solea*, but destitute of pectoral fins; dorsal and anal distinct from caudal; eyes and colours on the right side.

ACHIRUS PAVONINUS, Lacépède.

Achire pavonine, Lacépède, IV. 660.

Pleuronectes pavoninus, Shaw, IV. 310.

*Right side.* Ground colour of head, body and fins yellowish- or pink-brown; the fin-membranes dotted with black; scales edged with dark brown; head and body with numerous larger and smaller rounded milkwhite spots, edged and minutely dotted with dark brown, and with a round soot-coloured spot in the centre; a few of the white

spots confluent; base of dorsal and caudal with a series of spots like those of the body; the rest of these fins, the right ventral and the caudal with numerous smaller spots destitute of the brown central spot. Iris annular, golden; rest brownish.

*Left side.* Head and body brownish white or buff; opercle and abdomen pale bluish; filaments of the head white.

D 67, C 12 $\frac{3}{4}$ , A 50, V 5, P 0, Br. *right* VI; *left* V?

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 7 $\frac{3}{4}$  inch.

The length of the head is 6 $\frac{1}{2}$  in the total. The upper orbit is situated at the upper third of the head, at equal distance from the muzzle and the angle of the mouth; the horizontal diameter is  $\frac{1}{4}$  of the length of the head. The lower orbit is situated vertically below the upper, at a distance of 1 $\frac{1}{2}$  diameter immediately above and behind the angle of the mouth; it is a little larger than the upper orbit. Between the anterior angles of both appears like a pore the posterior aperture of the nostril; the anterior one is tubular, pierced through a small tubercle which is situated lower down, immediately above the centre of the upper lip. The jaws are equal; the mouth very little distorted to the left; the lips are fleshy. The right side is toothless, but on the left appear numerous, minute, setaceous teeth, so completely hid by the lips, that during life they easily escape observation. On the left side of the head and on the throat appear numerous small filaments. The tongue is minute, smooth, truncated triangular. The body forms a regular elongated oval; its greatest vertical diameter is a little less than  $\frac{1}{4}$  of the total length; this diameter contains about 67 series of scales. The latter are small, oval. On the posterior margin appear some spines so excessively minute, that the surface does not appear rough to the touch. The rest of the circumference of the scales is divided by upwards of 55 backwards radiating lines. The lateral line commences from the upper margin of the opercle; at first it slightly descends, and then continues in the middle of the side to the caudal; it contains about 99 central tubes. The dorsal commences very close to the upper lip, opposite the centre of the distance between the eyes; all the rays are divided; the anterior and posterior ones are a little shorter than the rest, which are about 2 $\frac{1}{2}$  in the length of the head. The anal resembles the dorsal, but the rays are a little longer. Both

fins have their basal third covered with scales. Immediately above the latter scales, on both sides of the fins, in the centre between each pair of rays, appears a very distinct rounded aperture, the margin of which is a little raised, and the bottom of which is formed by a lamina of the fin membrane. From the upper part of each aperture proceeds a linear fold, which may be traced to the external margin of the fins. Commerson discovered a similar row of pores along the base of the dorsal and anal rays of *Achirus marmoratus*, Lacépède;\* and later, Dr. Rüppell observed similar in *Achirus barbatus*, Geoffroy.† The caudal is scaly, rounded,  $\frac{2}{3}$  of the length of the head. The right ventral is broad, rounded; all the rays are divided,  $\frac{2}{3}$  of the length of the head; the fifth ray is throughout connected by a membrane to the first anal. The left ventral commences a little more backward; it is narrower and shorter, and not joined to the anal. A single individual was observed at Pinang in August 1843.

GEN. PLAGUSIA, Brown, 1756.

Dorsal, caudal and anal fins united; otherwise resembling *Achirus*.

*Eyes and colour on the left side.*

PLAGUSIA BILINEATA, (Bloch.)

*Pleuronectes bilineatus*, Bloch, Pl. 188.

*Pleuronectes bilineatus*, Linné: Syst. 1235.

Russell, LXXIV. Jerree Potoo E.

*Pleuronectes bilineatus*, Shaw, IV. 317.

*Plagusia bilineata*, Cuv. R. A. Ed., 224.(<sup>o</sup>).

*Plagusia bilineata*, Rüppell, Atlas, 123.

*Plagusia dipterygia*, Rüppell, ibid. 123, Taf. 31, Fig. 3, (*Young.*)

*Pleuronectes bilineatus*, Bennett: Life of Raffles, 692.

*Plagusia bilineata*, Rüppell: Neue Wirb. Fische, 84.

*Plagusia dipterygia*, Rüppell, ibid.

*Plagusia bilineata*, Swainson, II. 303.

*Plagusia bilineata*, Bleeker: Verh. Batav. Gen. XXII. 5.

Ikan lédah of the Malays.

\* Lacépède, IV. 660.—*Pleuronectes marmoratus*, Shaw, IV. 310.

† Ann. du Mus, I, Pl. XI.—Rüppell: Atlas, 122, Tab. 31, Fig. 2.

*Left side.* Pale reddish brown; scales with metallic iridescent reflections, with a pale dark brown longitudinal line, and with a buff or whitish vertical line along the root of the fine spines; opercle bluish or neutral tint; fin-membranes hyaline; rays buff. Iris narrow golden round the circular pupil; rest blackish blue.

*Right side.* Brownish white; opercle and abdominal cavity bluish.

D 96 or 97,

C 8, . . . . . left V 5, right V 4, P 0, Br. VI.

A 70 or 73,

174 or 178

HABIT.—*Sea of Malayan Peninsula and Islands.*

Coromandel, Bay of Bengal, Red Sea, Sumatra, Java, Madura.

TOTAL LENGTH: 9 inch.

*Left side.* The form of this as of all the following species is elongated lanceolate. The length of the head is  $4\frac{1}{2}$  in the total. The muzzle bluntly pointed; the distance to the anterior angle of the upper orbit is  $10\frac{1}{2}$  in the total length; the muzzle terminates downwards in a remarkably long sickle-shaped process, which extends below the lower jaw to opposite the angle of the mouth, or in young individuals a little beyond it.\* The distance from the muzzle to the point of the sickle-shaped process, its length, varies individually from  $5\frac{1}{2}$  to  $6\frac{1}{2}$  in the total length; in young individuals it is proportionally longer, slightly exceeding  $\frac{1}{2}$ . The upper orbit is situated in the centre of the head, above the middle of the upper lip; the horizontal diameter is  $\frac{1}{12}$  of the length of the head. The lower orbit is thrown farther back above the angle of the mouth; both are of about equal size, and their vertical distance but slightly exceeds the horizontal diameter. The left side of the jaw is toothless with fleshy papillular lips; in the right of both appear crowded fine setaceous teeth. A single nostril appears in front of the lower eye, close to the lip; the tongue is minute, rounded, smooth. The greatest vertical diameter of the body, at the commencement of the anal fin, equals the length of the

\* The young are farther distinguished by their excessively minute right ventral fin. The description and plate of *Plagusia dipterygia*, Rüppell, offer no specific distinguishing character.



head ; on it appear about 44 series of scales. The latter are elongated oval ; those of the body double the size of those of the head. The anterior margin carries upwards of 17 minute spines, rough to the touch ; the radical part upwards of 60 radiating lines. A line between the gill-opening and the caudal contains about 85 scales. The lateral line commences at the muzzle, ascends a little above the upper orbit ; from thence it is straight to near the upper margin of the opercle, where it makes a very short ascent, and then continues straight, nearly in the middle of the body to the caudal. Above the preopercle it gives off a short vertical branch, which again is divided in three principal branches : an upper which proceeds backwards to the margin of the opercle, a second obliquely downwards over the opercle, and a third, which following the anterior arch of the preopercle despatches a branch backwards to the lower part of the opercle, and terminates on the throat. Above the opercle the lateral line gives off another short branch which rises vertically, and divides in what is called the second lateral line of which the anterior branch proceeds near the base of the dorsal towards the muzzle, the posterior continues near the dorsal to the caudal. The dorsal commences far in front of the eyes at a short distance from the muzzle. The dorsal, caudal and anal rays are undivided, and nearly of equal length,  $\frac{1}{3}$  of the head, with the points slightly projecting beyond their membranes. The left ventral is situated at the gill-opening, on a level a little above the anal ; the first ray is very short and closely connected to the second ; the rest gradually increase in length ; the fifth is the longest,  $\frac{1}{3}$  of the head and by a membrane throughout connected to the first anal. The stomach is capacious, broad pyriform ; the intestinal canal simple, forming two circumvolutions ; its length is less than  $\frac{1}{3}$  of the total. Single individuals occur at Pinang at all seasons. They are of excellent flavour.

*PLAGUSIA CYNOGLOSSA*,\* (Buchan. Ham.) VAR. A.

Ikan lédah of the Malays.

*Left side.* Ground-colour pale reddish brown, posterior half of head

\* SYN. *Achirus cynoglossus*, Buchan. Hamilton, 132, 373. Marked *Achirus* *batwijiha* in Buchanan's duplicate series of drawings.

Hab. Bay of Bengal, mouths of the Ganges.

and the body largely spotted and marbled with blackish brown ; dorsal, caudal and anal rays brownish, their membranes pale brownish transparent, minutely dotted with black ; ventrals whitish. Iris golden, annular, rest bluish black.

*Right side.* Brownish white ; opercle and abdominal cavity pale bluish.

#### VAR. B

*Left side.* Differs from *Var. A* by having 7 or 8 vertical, blackish brown, distant bands not extending over the dorsal and anal ; head and intervals with irregular blackish brown spots.

D 100 or 102,

C 10, . . . . . V 4, P 0, Br. VI.

A  $\frac{76 \text{ or } 78,}{186 \text{ or } 190.}$

HABIT.—*Sea of Pinang.*

TOTAL LENGTH : 6 inch.

*Left side.* The length of the head is  $5\frac{1}{2}$  in the total. The distance from the very bluntly pointed muzzle to the upper eye is  $\frac{1}{11}$  of the total length ; the point proceeding downwards from the muzzle barely covers the symphysis of the lower jaw ; its length equals the distance from the muzzle to the upper eye. Both eyes are excessively minute, like points. The upper one is situated at the anterior third of the head, opposite the middle of the upper lip. The lower is a little farther back, immediately above the posterior third of the upper lip. The distance between both is apparently two diameters. No nostril is distinguishable. The left side of the lips is not papillular ; the right completely hides the minute teeth. The greatest vertical diameter of the body, in front of the anal, is  $4\frac{1}{2}$  in the total length ; on it appear 31 to 33 series of scales. The latter are on the body comparatively large, elongated oblong, with about 17 minute spines at the posterior margin, and about 36 radiating lines on the radical portion. There are about 81 on a straight line between the gill-opening and the caudal. The lateral line with its ramifications, resembles that of *P. bilineata*. The length of the pointed caudal is  $\frac{1}{2}$  of the head. The distance from the first anal to the first ventral ray equals that between the muzzle and the upper eye, which is nearly thrice that of these fins in *P. bilineata*.

*nesta*. In other respects the fins resemble those of the latter species. At Pinang single individuals occur, but rarely, which in addition to their small size, makes them less valued as an article of food.

### PLAGUSIA TRULLA, Cantor.

Ikan lédah of the Malays.

*Left side*. Pale dark reddish brown; opercles much darker than the rest; in some individuals a series of short, distant, vertical bluish lines under the anterior half of the dorsal, and above the anterior third of the anal; scales with a dark longitudinal line; posterior margin buff; fins transparent pale brownish, minutely but faintly dotted with black. Iris annular golden; rest bluish black.

*Right side*. Brownish white, opercles and abdominal cavity blackish blue.

D 109 or 111,

C 12, . . . . . *left* V 4, *right* 0; P 0, Br. VI.

A 80 or 86,

201 or 209

HABIT.—*Sea of Pinang, Malayan Peninsula.*

TOTAL LENGTH: 1 ft.

*Left side*. The length of the head is  $5\frac{1}{2}$  in the total. The distance from the rounded muzzle to the anterior angle of the upper orbit is from  $13\frac{1}{2}$  to  $1\frac{1}{4}$  of the total length. The point proceeding downwards from the muzzle covers the symphysis of the lower jaw; its length equals the distance between the muzzle and upper orbit. The latter is situated a little behind the anterior third of the length of the head, opposite the middle of the upper lip. The horizontal diameter is  $10\frac{1}{2}$  in the head. The lower orbit is placed a little farther back, still considerably in front of the angle of the mouth; it is a little smaller than the upper; the vertical distance between both slightly exceeds the horizontal diameter of the upper. Immediately beneath the latter appears a small, but remarkably developed bony protuberance, or spine. A single aperture of the nostril appears a little in front of the lower eye above the lip. The lips are fleshy, but not papillular, otherwise the mouth, tongue and dentition resemble *P. bilineata*. The greatest vertical diameter of the body, towards the middle, is  $4\frac{1}{2}$  to  $4\frac{3}{4}$  in the

total length. It contains 45 series of scales. For the size of the fish the latter are rather small, elongated oval, with about 21 radiating lines at the radical part, and 13 spines at the posterior margin, which is rough to the touch. A straight line between the opercle and the caudal contains about 117. The lateral line and its ramifications resemble *P. bilineata*. The distance between the muzzle and the first dorsal ray, and that between the first ventral and anal ray equal  $\frac{1}{2}$  of that between the muzzle and upper eye. The length of the caudal varies from  $2\frac{1}{2}$  to  $\frac{1}{2}$  of the length of the head. There is but a single ventral, on the left side, connected by a membrane to the anal. But for the absence of the ventral fin, the figure marked *Plagusia abbreviata* in *Illustrations of Indian Zoology*, II. Pl. 94, Fig. 3, might be supposed to represent the present species. Individuals, although never in great numbers, occur at all seasons at Pinang, and are highly valued for their flavour.

#### PLAGUSIA GRANDISQUAMIS, Cantor.

*Left side.* Pale reddish brown; scales with metallic iridescent reflections, a central dark longitudinal line, and the posterior margin buff; opercle and abdominal cavity bluish black; from above the opercle closely beneath the base of the dorsal a black band, gradually narrowing towards the caudal; from a little behind the abdominal cavity immediately above the base of the anal a similar black band joining the former at the root of the caudal; dorsal and anal pale brownish transparent, minutely dotted with black; caudal black, ventrals white. Iris annular golden, rest minutely dotted with black.

*Right side.* Brownish white; opercle and abdominal cavity bluish black.

D 116,

C 10, V 4, P 0, Br. VI.

A 88,

214

HABIT.—*Sea of Pinang.*

TOTAL LENGTH:  $7\frac{1}{2}$  inch.

*Left side.* The general form is narrow, elongated lanceolate, resembling *Plagusia lingua*, (Buchanan Hamilton.)

The length of the head is  $5\frac{1}{2}$  in the total. The distance from the oval muzzle to the anterior angle of the upper orbit is  $\frac{1}{12}$  of the total length; the point proceeding downwards from the muzzle is broad, barely covering the symphysis of the lower jaw; its length equals the distance between the muzzle and the upper orbit. Both orbits are nearly equal; the upper one is situated at the second fifth of the head opposite the middle of the upper lip; the horizontal diameter is  $\frac{1}{10}$  of the length of the head. The lower orbit is placed very little farther back than the upper. The interval between both is excessively narrow, a short linear septum; between the anterior angles of both appears a small pointed, triangular, bony protuberance. The nostril has a single aperture in front of the lower eye, above the upper lip. The lips are fleshy, not papillular; the excessively minute teeth on the right side are completely hid from view. The tongue is linear, smooth. The greatest vertical diameter, at the anterior third of the body, equals the length of the head. On it appear 17 series of remarkably large scales, of a broad oval form. The length of the largest is  $\frac{1}{2}$  of the head, their breadth  $\frac{1}{10}$ ; at the radical part appear upwards of 50 radiating lines; at the posterior margin 36 to 38 fine spines, rough to the touch. A straight line between the opercle and caudal contains 59 scales. The lateral line and its ramifications resemble those of *P. bilineata*. The dorsal commences at a distance from the muzzle of  $\frac{1}{2}$  of that from the latter to the upper eye; the longest rays, as well as the pointed caudal, is  $\frac{1}{2}$  of the head. The distance between the left ventral and the anal is  $\frac{1}{2}$  of that between the muzzle and the upper eye. Both ventrals are nearly equal,  $\frac{1}{2}$  of the head; the last ray of the left ventral is throughout united to the first anal. In other respects the fins resemble those of *P. bilineata*. A single individual occurred at Pinang in December 1842. The scales were deciduous, probably from decay. The fishermen were not acquainted with the species.

*PLAGUSIA LINGVA*, (Buchanan Hamilton.)

*Cynoglossus lingva*, Buchan. Ham. 32, 365.\*

'Ikan lédah' of the Malays.

*Left side.* Reddish brown; the scales with golden iridescent reflections, a dark longitudinal central line, and the posterior margin buff;

\* Marked *Acheiris jibba* in Buchanan's duplicate series of drawings.

opercle blackish blue ; sides with distant rounded and irregular blackish brown spots ; dorsal and anal pale brownish grey, transparent, minutely dotted with black ; the dorsal immediately in front of the caudal, and the latter itself, black ; ventrals white. Iris golden, annular ; rest blackish blue.

*Right side.* Brownish white ; abdominal cavity blackish blue.

D 137.

C 10, V 4, P 0, Br. VI.

A 107.

254.

**HABIT :** *Sea of Pinang.*

Bay of Bengal, Gangetic estuaries.

**TOTAL LENGTH :** 1 ft.

*Left side.* The length of the head is  $5\frac{1}{2}$  in the total. The distance from the oval muzzle to the anterior angle of the upper orbit is  $11\frac{1}{2}$  in the total length ; the point proceeding downwards from the muzzle projects a little beyond the symphysis of the lower jaw ; its length equals the distance between the muzzle and the upper orbit. The latter is situated in the centre of the length of the head, opposite the middle of the upper lip ; the horizontal diameter is  $\frac{1}{11}$  of the length of the head. The lower orbit is placed farther back a little in front of the angle of the mouth ; it is slightly smaller than the upper one. The vertical distance between the two equals the diameter of the upper. Between both appears a very distinct oval aperture, according to Buchanan Hamilton the posterior aperture of the nostril, which has another above the upper lip in front of the lower eye. The mouth, tongue, and dentition agree with *P. grandisquamis*. The greatest vertical diameter, at the anterior third of the body is  $6\frac{1}{2}$  in the total length. On it appear 31 series of elongated, irregularly oval scales with upwards of 37 radiating lines at the radical part. Those of the anterior part of the body have the centre of the posterior margin very finely ciliated, not rough to the touch ; in the rest of the scales this margin is smooth and bluntly pointed. A straight line between the opercle and caudal contains about 100 scales. The lateral line and its ramifications resemble those of *P. bilineata*. The dorsal commences very close to the point of the muzzle,  $\frac{1}{2}$  of the distance from the latter to the upper orbit ; the rays slowly increase towards the caudal, the

longest being  $\frac{1}{3}$  of the head. The caudal terminates in a very sharp point; its length is  $\frac{1}{2}$  of the head. The distance between the first, left, ventral and the anal ray is scarcely  $\frac{1}{3}$  of that between the point of the muzzle and the upper orbit. The right ventral is smaller and so near the left, which is closely connected with the anal, that Buchanan Hamilton overlooked both. In other respects the fins resemble those of *P. bilineata*. Single individuals occur, but rarely, at Pinang.

**PLAGUSIA POTOUS, Cuvier.**

Russell, LXXIII. Jerree Potoo D.

*Plagusia potous*, Cuvier, R. A. II. 344 (').

Ikan lédah of the Malays.

*Left side.* Lighter or darker copper-red; the scales with strong metallic iridescent reflections; opercle and abdominal cavity pale blackish blue; fins transparent pale brownish, minutely dotted with brown; caudal blackish; ventrals whitish. Iris annular, pale golden; rest blackish blue; superior margin of the upper orbit and lower of the inferior with a buff crescent-shaped membrane.

*Right side.* Brownish white; opercle and abdominal cavity pale bluish.

D 126 or 127.

C 10, . . . . . V 4, P 0, Br. VI.

A 94 or 95.

230 or 232.

**HABIT:** *Sea of Malayan Peninsula and Islands.*

Coromandel.

**TOTAL LENGTH:** 1 ft. 2 inch.

*Left side.* The length of the head is  $5\frac{1}{2}$  in the total. The distance from the centre of the oval muzzle to the anterior angle of the upper orbit is from  $11\frac{1}{2}$  to  $\frac{1}{15}$  of the total length. The point proceeding downwards from the muzzle covers the symphysis of the lower jaw, or is a little shorter; its length equals the distance between the muzzle and the upper orbit. The latter is situated a little in front of the centre of the length of the head, opposite the middle of the upper lip; the horizontal diameter is  $\frac{1}{11}$  of the length of the head. The lower orbit, in size equals the upper; it is placed little farther back, considerably in front of the angle of the mouth. The vertical distance between

both equals the horizontal diameter. In front of the lower orbit, above the lip, appear two small apertures of the nostril, separated by a narrow membranous septum; the lower is oval, double the size of the circular upper one, which opens under a small bony protuberance. The mouth, tongue, and teeth resemble those of *P. grandisquamis*. The greatest vertical diameter of the body, at the anterior third, is  $5\frac{1}{2}$  in the total length. On it appear 23 series of oval scales, of which the largest are  $\frac{1}{2}$  of the length of the head; their breadth  $\frac{1}{12}$ . The radical part is marked with upwards of 46 radiating lines; the posterior margin with 36 to 38 very minute spines, barely perceptible to the touch. A straight line between the opercle and the caudal contains 69 scales. The lateral line and its ramifications resemble those of *P. bilineata*. The fins resemble those of *P. lingua*. The description of Russell gives 148 dorsal rays, which probably is a misprint instead of 128. At all events there is a great discrepancy between the description and the plate which represents 165 dorsal and 155 anal rays. The form of all the fins is incorrect. At Pinang this species occurs, although never in great numbers, at all seasons. It is of excellent flavour, and, like *Plagusia trulla*, passes at European tables under the denomination of "Sole."

With the exception of *Plagusia grandisquamis*, which was not observed alive, the other species are all distinguished for their tenacity of life. The fishermen at Pinang assert that some species of *Plagusia* shoal at certain seasons.

## ORDO PHARYNGOGNATHI.

### SUBORDO PHARYNGOGNATHI ACANTHOPTERYGII.

#### FAM. SCAROIDÆ.

GEN. JULIS, Cuvier, 1817.

Head smooth, without scales; lateral line forming an elbow opposite the end of the dorsal fin.

JULIS DUSSUMIERI, Cuv. and Val.

Julis dussumieri, Cuv. and Val. XIII. 478, Pl. 387.

Ground-colour of the head and body light green; abdomen greenish



white; on the upper part of the head some vermilion spots; a broad vermilion band edged with deep blue from the eye to the angle of the mouth; a second obliquely over the cheek towards the angle of the mouth; a third on the preopercle; a fourth on the temple round the eye; a fifth along the upper margin of the opercle; a sixth, angular, on the upper half of the opercle; on the lower half a large vermilion spot; a seventh on the subopercle; each of the scales of the back and sides with a large central vermilion spot; in front of the vermilion root of the pectorals a large dark-blue spot; pectorals hyaline, the rest of the fins pale yellowish green; dorsal with a series of oblique vermilion lines along the base; a central brownish-lilac undulating line between the five first spines; between the fifth and sixth a large dark-blue spot; between the succeeding spines and rays a large triangular brownish lilac spot occupying the upper half of the membrane; upper margin vermilion; angles of the caudal with a triangular orange spot with a basal vermilion line; two indistinct vertical brownish bands in the middle, the whole fin with numerous small blue spots; anal with a series of oblique vermilion lines along the base; upper half brownish lilac, the three spines with vermilion points; first and second ventral rays vermilion. Iris narrow golden, next vermilion, orbital margin brownish green with a vermilion spot at the lower half.

D 9/12, C 14½, A 3/12, V 1/5, P 16, Br. V.

HABIT.—*Sea of Pinang.*

Malabar.

TOTAL LENGTH: 6½ inch.

The length of the head is 4½ in the total. The eye occupies the third-fifth of the head, and the upper third of the vertical diameter passes through it; the horizontal diameter is ½ of the length of the head. The greatest vertical diameter of the body equals the length of the head. The tooth on each side of the symphysis of the upper jaw is longer than the succeeding seven of the external series, which gradually decrease in length. At the angle of the mouth at some distance from the last tooth appears a strong obliquely downwards and forwards pointed tooth. Two teeth on each side of the symphysis of the lower jaw are longer than the rest, which are smaller than the corresponding ones of the upper jaw. The scales of the body are large, striated. A longitudinal series contains 26, an oblique 11. The lateral line consists

of tubes, each with a smaller superior and an inferior tube branching off backwards. The anterior part of the line rises obliquely towards the sixth dorsal spine, the rest proceeds straight along the upper fourth of the body towards the ninth ray, when it declines a little and proceeds straight towards the caudal. The posterior margin of the latter fin is rounded. The last ray of the dorsal and the anal, and the first ray of the ventrals are elongated into a very short filament. The anterior anal spine is very minute. The figure of M. M. Cuvier and Valenciennes does not quite correspond to their very correct description. A single individual occurred at Pinang in June 1844.

**JULIS MOLA, Cuvier.**

Russell, CXX. Sahnee Moia.

Julis mola, Cuvier, R. A. II. 258.

Sahnee moia, Cuv. and Val. XIV. 234.

Ground-colour of the head and body pale sea-green; abdomen whitish green; from the muzzle over the forehead along the base of the dorsal a dark brown longitudinal band; a second from the side of the muzzle through the eye along the middle of the side to the root of the caudals; the two bands in some consisting of two or three series of spots; on the upper part and sides of the head some irregular orange streaks; pectorals hyaline, red at the root; ventrals white; rest of the fins pale yellowish green; dorsal with an undulating pale blackish band along the base and a second along the middle; in some a black spot either between the fifth and seventh spine, or between the first and second; caudal with some pale bluish spots, and in some with a black spot at the root; anal with pale blackish spots near the margin. Iris narrow golden, next vermilion; orbital margin dark brown.

D 9/12, C 14½, A 2/12, V 1/5, P 15, Br. V.

HABIT.—*Sea of Pinang.*

Coromandel.

TOTAL LENGTH: 4½ inch.

The length of the head is 3½ in the total. The diameter of the eye, situated as in *J. dussumieri*, is ½ of the length of the head. The dentition and scales resemble those of the latter species. A longi-

tudinal series contains 27, an oblique 13 scales. The lateral line proceeds straight along the upper fourth of the body towards the ninth dorsal ray, from whence it declines towards the middle of the side and proceeds straight towards the caudal. The line is composed of tubes, from each of which, anterior to the ninth dorsal ray, branch off backwards a superior and inferior smaller tube. The greatest vertical diameter of the body equals the length of the head. The first seven dorsal spines are shorter than the rest, which makes the anterior part of the fin lower than the posterior. The stomach is a short elongated tube, slightly more voluminous than the intestinal canal which is thrice doubled upon itself. The length of both is  $\frac{1}{3}$  of the total. The air-vessel is small, elongated conical, of a silvery colour. Single individuals occur, but rarely, at Pinang.

GEN. SCARUS, Gronov. 1763.

Jaws (intermaxillary and premandibular bones) convex, rounded, with teeth, arranged like scales, on their edge and anterior surface; lips single, fleshy; body oblong with large scales; lateral line interrupted; one inferior and two superior pharyngeal plates with teeth like transverse laminæ.

SCARUS PSITTACUS, Forskål.

*Scarus psittacus*, Forskål, 29.

*Scarus psittacus*, Shaw, IV. 397.

*Scarus psittacus*, Cuv. R. A. II. 266 (').

*Scarus psittacus*, Rüppell: Atlas, 77, Tab. 20, Fig. 1.

*Scarus psittacus*, Rüppell: Neue Wirbelth. Fische, 28.

*Scarus psittacus*, Cuv. and Val. XIV. 226.

*Petronason psittacus*, Swainson, II. 226.

*Young.* Head above and ground-colour of the back and sides greenish light-blue; all the scales of the latter parts with broad orange margins, forming a net-work; cheeks, opercles, throat and abdomen reddish white; upper lip surrounded by a light blue streak; a second similar from the angle of the mouth obliquely upwards surrounding the lower half of the orbit; a third from the chin to the cheek; a fourth at the anterior margin of the preopercle obliquely backwards over the opercle; a fifth along the posterior margin of the preopercle;

from the orbit radiate two upwards and two backwards; in front of the pectoral at the margin of the gill-opening an irregular, light blue spot; dorsal reddish orange; rays, upper and basal margin light blue; caudal membrane yellowish brown, base, upper, lower and posterior margin as well as the rays light blue; anal reddish orange, base and lower margin light blue; spine and point of the ventrals light blue; anterior half of the membrane orange, posterior half white; pectorals yellowish white, second ray light blue. Iris narrow golden round the pupil; rest greenish olive.

D 9/10, C  $13\frac{1}{3}$ , A 3/9, V 1/5, P 15, Br. V.

HABIT.—*Sea of Pinang.*

Red Sea.

TOTAL LENGTH:  $10\frac{1}{4}$  inch.

The length of the head is  $3\frac{1}{2}$  in the total. The horizontal diameter of the orbit is  $4\frac{1}{2}$  in the length of the head. The vertical diameter at the occiput equals the length of the head; the greatest vertical diameter of the body slightly exceeds the length of the head. The body is covered by eight longitudinal series, each containing 23 scales. The lateral line consists of backwards branching tubes. The line continues on the third longitudinal series to the termination of the dorsal fin; a single tube then appears on the succeeding scale of the fourth series; the completing part of the line occupies the five posterior scales of the fifth longitudinal series. This species greatly resembles *Scarus harid*, Forskål, from which it differs in having the outline of the abdomen much more convex than that of the back, and in having the angles of the caudal much less elongated. The first of the undivided anal rays is very short and so closely adhering to the second, that it easily may escape observation. A single individual occurred at Pinang in May 1844.

### FAM. GLYPHIDODONTIDÆ.

GEN. TETRADRACHMUM,\* *Cantor.*

(Equivalent to *DASYLLUS*, *Cuvier.*)

Shape oblong; head obtuse; teeth velvety, the external series

\* *Τετραδραχμον*, a coin, worth four drachms. Substituted for *Dasyllus*, *Cuvier*, 1829, pre-occupied by *Dascyllus* (scrib. *Dascylus*.) *Latroille*, 1796, (*Coleoptera*).

stronger than the rest, conical, pointed; preopercle toothed, lateral line terminating opposite the soft part of the dorsal fin; branchiostegous rays five.

**TETRADRACHMUM ARCUATUM, (Linné.)**

*Chætodon arcuatus*, Linné: Mus. Ad. Fr. I. Pl. 33, Fig. 5.

*Chætodon arcuanus*, Linné: *ibid.* Fig. 8.

*Chætodon abudafur*, Forskål, 65, No. 93.

*Chætodon arcuatus*, Linné: Syst. 1243.

*Chætodon arcuanus*, Linné: *ibid.* 1250.

*Chætodon aruanus*, Bloch, Tab. 198, Fig. 2.

*Lutjan aruane*, Lacépède, IV. 720.

*Chætodon arcuatus*, Shaw, IV. 341.

*Chætodon aruanus*, Shaw, IV. 348.

*Dascyllus aruanus*, Cuv. R. A. II. 179<sup>(6)</sup>.

*Pomacentrus aruanus*, Rüppell: Atlas, 39.

*Dascyllus aruanus*, Bennett: Life of Raffles, 688.

*Chætodon araneus*, Bennett: Ceylon, No. 17.

*Dascyllus aruanus*, Rüppell: Neue Wirbelth. Fische, 129.

*Dascyllus aruanus*, Cuv. and Val. V. 434.

*Dascyllus aruanus*, S. Müller and Schl. Verh. 21.

*Dascyllus aruanus*, Bleeker: Verh. Batav. Gen. XXI. 1 Ged. 2, 5.

Alternately black and white; the anterior band black, occupying the space from the throat to the third dorsal spine, excepting the forehead, from between the eyes to the lips, which is white; next a second oblique whitish band bordering upon the root of the ventrals and the pectorals, and continuing along the sixth dorsal spine; next a black band, comprising the ventral fins to a little in front of the anus, over the sides, and over the seventh, eighth and ninth dorsal spine; next a whitish band from the second anal ray, not comprising the spiny portion which is black, over the body along the first dorsal ray; next a nearly vertical black, comprising the rest of the anal rays, the anterior half of the narrow part of the body in front of the caudal, and the rest of the dorsal rays; the rest of the space in front of the caudal is whitish, the anterior half of the latter fin is black, the rest paler or grey; pectorals bluish- or greyish-white. Iris narrow silvery round the pupil, the rest bluish black.

D 12/12, C 15½, A 2/12, V 1/5, P 16, Br. V.

HABIT.—*Sea of Pinang.*

South Sea, Timor, Amboina, Indian Ocean, Bay of Bengal,

TOTAL LENGTH : 24½ inch.

Red Sea.

Three individuals were observed at Pinang from 1842 to 1845.

Gen. GLYPHIDODON, (*Forskål.*) *Lacépède*, 1802.

Body compressed oval, and as well as the head covered with large scales; profile rounded; mouth small; teeth in the jaws in a single series, close, equal, narrow, trenchant and frequently notched; preopercle not toothed; lateral line terminating opposite the last dorsal ray.

GLYPHIDODON RAHTI, Cuv. and Val.

Russell, LXXXVI. Rahti Pota.

Glyphisodon saxatilis, Rüppell: Atlas, Fische, 35?

Chaetodon tyrwhitti, Bennett: Ceylon, No. 25?

Glyphisodon rahti, Cuv. and Val. V. 456; IX. 507.

Glyphisodon rahti, Rüppell: N. W. Fische, 126.

Glyphisodon rahti, S. Müller and Schlegel: Verh. over de nat.  
Gesch. 22.

Glyphisodon tyrwhitti? } Richardson: Rep. 1845, 253.  
Glyphisodon rahti? }

Glyphisodon caelestinus, Cantor: Catal. Mal. Mamm. in Journ. As.  
Soc. XV. [*Delphinus plumbeus*.]

Glyphisodon rahti, Bleeker: Verh. Bat. Gen. XXI. 1 Ged. pp.  
2, 3, 5.

Upper part of the head and the back as far as the dorsal fin greenish or bluish-black, rest of the back and upper half of the sides greenish yellow or gamboge, lower half of the sides, abdomen, cheeks and opercles bluish silvery, all the scales with blackish margins. In front of the dorsal a vertical black band; a second from between the sixth and seventh dorsal spine; a third from the posterior spines; a fourth from the soft dorsal fin; a fifth in front of the caudal; scales between the dorsal spines and rays yellow or greenish, membrane blackish-blue with a broad black margin; the scaly base of caudal yellow, the rest greenish or bluish-black with a broad black posterior margin; in some a broad vertical black band behind the base, and the upper and

lower margin black ; the scaly base of the anal bluish silvery, the rest bluish black or grey ; pectorals transparent bluish white, with a black spot at the upper part of the root. Iris golden near the pupil, the rest blue or black.

D 13/13 or 12, C 15 $\frac{1}{2}$ , A 2/12, V 1/5, P 18 or 19, Br. VI.

HABIT.—*Sea and estuaries of Pinang, Malayan Peninsula, Singapore.*

New Guinea, Celebes, Java, Ceylon, Bay of Bengal, Bombay, Red Sea:

TOTAL LENGTH : 6 inch.

Not only are the ground colours liable to individual variations according to the yellow or bluish being the prevailing, but the vertical bands are broader or narrower, and the three middle ones are in some continued over the dorsal fin. In some the black bands are very indistinct or almost obliterated, as in the one figured by Russell, No. LXXXVI. in others a few distant black spots appear on the opercles and between the bands (*Chætodon tyrwhitti*, Bennett) ; the black spot of the pectorals is absent in some, in others it is a continued line along the root of the fin. All ages are subject to these variations. Young individuals are numerous at Pinang at all seasons, but adult ones are seldom seen. They are eaten by the natives.

## SUBORDO PHARYNGOGNATHI MALACOPTERYGII.

### FAM. SCOMBERESOCIDÆ.

#### GEN. *BELONE*, Cuvier, 1817.

Jaws forming an elongated beak, the upper part principally composed of the intermaxillaries, the base of the maxillaries ; teeth in both jaws, those of the internal margin longer and more distant than the rest ; those of the external margin small, pointed and closely set ; lips none ; under the symphysis of the lower jaw a short, soft, fleshy appendage ; with one exception, no teeth on the vomer ; pharyngeal teeth small conical ; body elongated with small scales ; bones of the skeleton green.

**BELONE ANNULATA, Cuv. and Val.**

Russell, CLXXV. Wahlah Kuddera.

*Belone annulata*, Cuv. and Val. XVIII. 447, Pl. 550.

Toda of the Malays.

*Adult.* Head above and back sea-green with steel-blue reflections, minutely dotted with black; lighter, silvery on the upper half of the sides; lower half and abdomen silvery white; cheeks and opercles silvery; side of the upper mandible blackish olive, of the lower silvery, with a black line from the angle of the mouth along the base of the teeth; dorsal, caudal and pectoral membranes pale greenish grey, minutely dotted with black, particularly towards the margins; anal and ventrals white, their anterior part minutely dotted with black. Iris silvery, orbital margin black.

*Young.* Head and back olive green; above the lateral line a narrow greenish silvery longitudinal band; opercles with a large black spot; lower mandible black; posterior two-thirds of dorsal black; on the middle of the caudal a large black spot.

D 22 or 23, C  $15\frac{1}{2}$ , A 21 or 22, V 6, P 13 or 14, Br. XV.

(*Young*: XIII.)

**HABIT.**—*Sea of Pinang, Malayan Peninsula.*

Seychelles, Tongatabu, Celebes, Pondicherry, Vizagapatam.

**TOTAL LENGTH:** 2 ft. 6 inch.

The young differs from the adult not only in colours, but in relative dimensions. In an individual,  $6\frac{2}{3}$  inches in length, the head is  $3\frac{1}{2}$  in the total. The vertical diameter at occiput is  $\frac{1}{4}$  of the length of the head. The horizontal diameter of the eye is  $7\frac{1}{2}$  in the head, measured from the symphysis of the lower mandible, and  $2\frac{1}{2}$  in the distance from the anterior margin of the orbit. The distance across the forehead is a little less than the diameter of the orbit. The posterior rays of the dorsal fin exceed by about  $\frac{1}{3}$  the length of the anterior ones. The abdominal crest is barely distinguishable. The tongue is fleshy, naked. In another, 11 inches in length, the head is a little more than  $3\frac{1}{2}$  in the total; the vertical diameter at occiput is  $5\frac{1}{2}$  in the head; the horizontal diameter of the eye is  $8\frac{1}{4}$  in the head, measured from the symphysis of the lower mandible, and  $\frac{1}{3}$  of the distance from the anterior margin of the orbit; the distance across the forehead slightly exceeds the diameter of the orbit; the posterior dorsal rays exceed by  $\frac{1}{4}$  the ante-



rior ones; the abdominal crest is distinct, particularly on the posterior fifth of the body; the margin of the tongue is studded with two or three series of minute polygonal bony plates, placed beside each other like mosaick; the black spots of the opercles and caudal are no longer visible. In an individual, 2 ft. 3 inches in length, the length of the head is  $3\frac{1}{2}$  in the total; the vertical diameter at occiput is  $\frac{1}{2}$  of the head; the horizontal diameter of the eye is  $\frac{1}{5}$  of the length of the head from the symphysis of the lower mandible, and  $3\frac{1}{2}$  in the distance measured from the anterior margin of the orbit; the distance across the forehead exceeds by  $\frac{1}{2}$  the diameter; the posterior dorsal rays, although somewhat elongated, are but  $\frac{1}{2}$  the length of the second ray.\* Immediately in front of the caudal the abdominal crest is very sharp, but becomes less so at its termination on the anterior third of the caudal. The hyoid bone and the tongue are entirely covered with a mosaick of small polygonal rough bony plates. The internal surface of the lower mandible presents a structure, which if present in other species, has not been described. The middle where the two branches join each other, is raised and forms a bony ridge, commencing behind the symphysis and gradually widening towards its termination in front of the apex of the tongue. The upper surface of this ridge is flattened, but made uneven by numerous transversal sharp bars, or rather by one continued closely waved bar, forming a kind of grate. The ridge is separated from the teeth by a deep groove, intervening on each side, and is covered by the fine membrane lining the rest of the cavity. In the young it differs by having a comparatively smaller number of transversal bars. The corresponding surface of the upper mandible is smooth, with a longitudinal fissure. In the adult fish the two anterior branchiostegous rays are so very minute, that they may easily escape observation; in young ones they appear to be absent. At Pinang this species is numerous at all seasons, but large individuals are scarce. In several examined, both of the present and the following species, the stomach contained nothing but thick mucus. The fish is eaten by the natives, although it is very insipid.

\* The figure of Russell is in this respect correct; but the last dorsal ray is placed too near the caudal. The distance between the two fins exceeds by  $\frac{1}{2}$  the length of the last dorsal ray.

## BELONE CAUDIMACULA, Cuvier.

Russell, CLXXVI. Kuddera, A.

*Belone caudimacula*, Cuv. R. A. II. 285 (?).

*Belone caudimacula*, Cuv. and Val. XVIII. 452.

*Belone caudimacula*, Bleeker : Verh. Bat. Gen. XXII. 5.

Toda of the Malays.

Head above and back yellowish green minutely dotted with brown; lighter, silvery on the sides; posterior half of the latter with a deep-blue longitudinal band, bordered beneath by a broader shining silvery one; abdomen white; sides of mandibles, cheeks and opercles silvery; dorsal, and in some the anal bright yellow, minutely dotted with brown along the rays; caudal yellow or greenish, minutely dotted with black, with a rounded bluish black spot in the centre near the root; ventrals and pectorals hyaline, the latter in some with a black spot along the root. Iris silvery, orbital margin bluish black.

D 13, C 15½, A 16, V 6, P 10, Br. XII?

HABIT.—*Sea of Pinang, Malayan Peninsula.*

Bombay, Aleppoe (in fresh water), Coromandel, Gangetic estuaries, Rangoon, Canton, River Brunai (Borneo), Port Essington, North Australia.

TOTAL LENGTH: 1 ft. 1 inch.

In an individual of the length given the head was contained 2½ times in the total length. The vertical diameter at occiput was ¼ of the length of the head. The horizontal diameter of the eye was 10½ of the length of the head, measured from the symphysis of the lower mandible, and ¼ of the distance from the anterior margin of the orbit. The abdominal crest becomes most distinct on the tail. The internal series of long sharp teeth appear proportionally shorter in this than in the preceding species. The tongue is smooth. On the inside of the lower mandible is a bony, grated ridge like that of the preceding species, and *Belone canila* (Buchan. Ham.) is provided with a similar. Single individuals, all of nearly equal length, occur at Pinang at all seasons. They are eaten by the natives.

GEN. HEMIRAMPHUS, Cuvier, 1817.

Upper jaw very short, formed by the intermaxillaries; symphysis of lower jaw extended into a long point, behind which on the margins of

both jaws a narrow band of small teeth; scales large, rounded, forming a carinated range on each side of abdomen; body and fins resembling *Belone*.

**HEMIRAMPUS RUSSELLI, Cuv. and Val.**

Russell, CLXXVII. Kuddera, B.

*Hemiramphus brevirostris*, Cuv. R. A. II. 286 (\*).\*

*Hemiramphus brevirostris*, Swainson, II. 297.

*Hemiramphus russelli*, Cuv. and Val. XIX. 32.

Tóda péndek† of the Malays.

Head above and back bluish black; lighter, silvery on the sides above the lateral line; rest of the sides, abdomen and opercles silvery with steel-blue reflections; fins hyaline; marginal half of dorsal and caudal minutely dotted with black; sides of lower mandible black. Iris silvery, orbital margin bluish black.

D 17, C 15½, A 13, V 6, P 12, Br. XIII.

HABIT.—*Sea of Pinang, Malayan Peninsula.*

Coromandel.

TOTAL LENGTH: 10 inch.

The length of the head from the apex of the intermaxillaries is  $\frac{1}{4}$  of the total measured to the point of the lower, longer, caudal lobe. The length of the lower jaw, from the apex to the angle of the mouth, slightly exceeds the length of the head, varying in different individuals from  $\frac{1}{4}$  to  $\frac{1}{2}$  of the distance to the point of the lower caudal lobe. The horizontal diameter of the eye is  $\frac{1}{4}$  of the length of the head; the distance across the forehead equals  $1\frac{1}{2}$  diameter. The depth at occiput slightly exceeds  $\frac{1}{2}$  of the length of the head, and is but  $\frac{2}{3}$  of the greatest vertical diameter of the body, in front of the ventrals. The length of the pectorals is  $\frac{1}{4}$  less than that of the head, which is exceeded by  $\frac{1}{4}$  by that of the lower caudal lobe. The upper caudal lobe is  $\frac{2}{3}$  of the lower. The ventrals are placed opposite the posterior third of the distance between the apex of the intermaxillaries and the root of the

\* Cuvier refers this species to Russell No. CLXXVII, and to Willughby: Append. Pl. VII. Fig. 4, two distinct species according to M. Valenciennes, who therefore has changed the specific denomination.

† *Péndek*, short. The Malays thus denominate all the species of *Hemiramphus*, to distinguish them from those of *Belone* (*Tóda*).

caudal. At Pinang this species is numerous at all seasons, but larger individuals occur at irregular intervals. They appear at European tables under the appellation of "Guard-fish."

**HEMIRAMPHUS GEORGII, Cuv. and Val.**

*Hemiramphus georgii*, Cuv. and Val. XIX. 37, Pl. 555.

Tóda péndek of the Malays.

*Young.* Head above light greenish grey, minutely dotted with black, particularly on the intermaxillaries and about the occiput; back and sides towards the lateral line pale greenish grey; the margins of the scales minutely dotted with black; along each side a shining silvery band, divided in the middle by the lateral line, and edged above by a deep blue line; abdomen faint silvery white; opercles shining silvery with steel-blue reflections; lower jaw greenish grey with a black marginal membrane; dorsal and caudal pale greenish grey, marginal half dotted with black; rest of the fins byaline. Iris silvery; orbital margin bluish black.

D 15 or 16, C  $15\frac{1}{2}$ , A 15, V 6, P 12, Br. XII?

**HABIT.**—*Sea of Pinang.*

Bombay, Mahé.

The length of the head from the apex of the intermaxillaries is  $5\frac{1}{2}$  in the distance to the point of the lower caudal lobe. The length of the lower jaw from the apex to where the teeth of both sides meet, varies individually from  $3\frac{2}{3}$  to  $3\frac{1}{2}$  in the total length. The horizontal diameter of the eye is  $\frac{1}{4}$  of the length of the head; the distance across the forehead exceeds by  $\frac{1}{4}$  the diameter. The arch of the roof of the orbits makes the middle of the forehead appear excavated. The depth at occiput is  $\frac{1}{4}$  of the length of the head. The band of teeth of the intermaxillaries is very narrow at the angle of the mouth, gradually widening towards the apex. The inner series of these teeth are somewhat longer than the rest. The lower jaw has but a single series of minute teeth, behind which the anterior half of the mouth is lined by a crescent-shaped black membrane. The length of the pectorals is  $\frac{2}{3}$  of that of the head. The ventrals are placed opposite the posterior third of the distance between the occiput and the root of the caudal. The vertical diameter in front of the ventrals is a little more than  $\frac{1}{4}$  the length of the head. The caudal is but slightly cleft; the lower lobe,

but little longer than the upper, is  $\frac{1}{2}$  of the length of the head. The two anterior dorsal rays are undivided. M. Valenciennes counts 17 rays in this fin, but his figure gives 16. Single young individuals occur at Pinang at all seasons.

**HEMIRAMPHUS TRIDENTIFER, Cantor.**

**Tóda péndek of the Malays.**

Head above, back and upper part of the sides light bluish green, minutely dotted with black, particularly towards the margin of the scales; along each side a shining silvery band, widening between the dorsal and anal; narrower in front of the caudal; the band edged above by a deep blue line, and longitudinally divided by the lateral line; rest of the sides and abdomen pale silvery white; cheeks and opercles shining silvery, the latter and the root of the lower jaw with strong steel-blue reflections; point of lower jaw greenish blue minutely dotted with black, with a black marginal membrane, apex red sealing-wax colour; dorsal hyaline, margins of the rays minutely dotted with black; anterior half of caudal pale greenish buff, posterior half, upper and lower margin pale blackish, rest of the fins hyaline. Iris silvery, upper half of orbital margin bluish black.

D 13 or 14, C 15 $\frac{1}{2}$ , A 14 or 15, V 6, P 13, Br. XII or XIII.

**HABIT.**—*Sea of Pinang.*

**TOTAL LENGTH:** 7 inch.

The length of the head from the apex of the intermaxillaries is  $5\frac{1}{2}$  in the distance to the point of the lower caudal lobe. The length of the lower jaw from the apex to where the teeth of both sides meet varies from  $6\frac{1}{2}$  to  $6\frac{3}{4}$  in the total length. Measured to the angle of the mouth, the lower jaw is from  $5\frac{1}{2}$  to  $5\frac{3}{4}$  in the total length. The horizontal diameter of the eye is  $\frac{1}{2}$  of the length of the head; the distance across the flattened forehead equals the diameter. The depth at occiput equals  $\frac{1}{2}$  of the length of the head. The teeth of both jaws are placed on narrow bands; in the centre of the lower jaw there is a very minute interval between the teeth of both branches. The teeth themselves are very minute, the internal series a little longer than the rest. Examined through a lens the apex of each tooth appears compressed, terminating in three minute points of which the central one is a little longer than the two lateral. The intermaxillary forms a nearly

equilateral triangle, each side of which is  $\frac{3}{4}$  of the horizontal diameter of the eye; the band of teeth of the lower jaw is longer, arched or like a horse-shoe. The length of the pointed pectorals is  $\frac{3}{4}$  of that of the head; the ventrals, slightly exceeding  $\frac{1}{2}$  of the pectorals, are placed far forward; they commence in the middle of the distance between the anterior margin of the orbit and the root of the caudal. The vertical diameter in front of the ventrals is  $6\frac{1}{2}$  in the distance between the gill-opening and the root of the caudal. The dorsal commences a little behind the posterior third of the distance between the occiput and the root of the caudal; the extent of the base is  $\frac{3}{4}$  of the length of the head; the first and second ray undivided; the latter and the third are the longest,  $\frac{3}{4}$  of the extent of the base. The last ray is a little elongated. The anal is placed opposite the dorsal, which it resembles in shape and extent. The caudal is but slightly cleft; the lower lobe equals the length of the head; the upper one about  $\frac{1}{2}$  less. The scales are large, rounded; the vertical diameter of the part exposed is about the double of the horizontal. The abdominal crest is distinct. This species has several characters in common with *H. gernaerti*, Cuv. and Val., but it differs from that and from all the other species by its peculiar dentition. In *Exocoetus volitans*, Linné, the pharyngeal teeth before they become worn, are flattened and triacpidate. Perhaps it may be inferred that the individuals of the present species are young, although the young of the preceding species have simple pointed teeth. They are numerous at all seasons at Pinang, and are eaten by the natives.

GEN. EXOCOETUS, (*Artedi*.) Linné, 1748.

Pectorals excessively large; head and body scaly with a salient line on each side of the abdomen; head depressed; cheeks compressed; eyes large; intermaxillaries without pedicles, forming the edge of the upper jaw; dorsal placed opposite the anal; intermaxillaries with minute pointed teeth; pharyngeals with teeth as if paved.

EXOCOETUS NIGRIPENNIS, CUV. and VAL.

*Exocoetus nigripennis*, Cuv. and Val. XIX. 108.

Head above, back and upper half of the sides ultramarine with

purple gloss ; lower half of the sides, abdomen, cheeks and opercles light silvery ultramarine, minutely dotted with black ; dorsal, ventrals and pectorals black ; pectoral rays silvery sky-blue ; caudal yellowish white, at the root bluish dotted with black ; anterior half of ventrals hyaline, posterior black, base blue. Iris silvery, orbital half bluish black.

D 11, 12 or 13, C 15 $\frac{3}{4}$ , A 8, 9 or 10, V 6, P 15, Br. XI.

HABIT.—*Sea of Pinang.*

China Sea.

TOTAL LENGTH : 3 inch.

The length of the head is  $5\frac{1}{4}$  in the total, measured to the point of the lower caudal lobe. The horizontal diameter of the eye is  $\frac{1}{4}$  of the length of the head. The arch of the roof of the orbit makes the middle of the forehead appear excavated ; the distance across the forehead between the posterior angles of the orbit slightly exceeds the diameter of the eye ; between the anterior angles it is slightly less than the diameter. The depth at occiput, as well as the vertical diameter in front of the ventrals, is  $\frac{1}{4}$  of the length of the head. The scales of the body are rather large, and so deciduous that few are in their places. The lateral line and the salient line on each side of abdomen can barely be traced. The teeth of both jaws are excessively minute and apparently confined to the central part. Each palatal has a single external series of minute teeth, and a few scattered over the surface, which appears like a fine file. The teeth are probably deciduous, and so minute that they cannot be seen in fresh specimens, and in dried ones only by means of a powerful lens. The pharyngeal teeth are tricuspid. The lower margin of the horizontal part of the preopercle is toothed. The length of the pectorals differs individually : they do not exceed  $\frac{1}{4}$  of the head and body, (the caudal not included). The ventrals are  $\frac{1}{4}$  of the total length ; the lower caudal lobe is  $4\frac{1}{4}$  in the total length, the upper one but slightly exceeds  $\frac{1}{4}$  of the former. The intestinal canal is wide at œsophagus, gradually narrowing in its straight course towards the anus. Its length is scarcely  $\frac{1}{4}$  of the total. The liver consists of a single small lobe. The white air-vessel is comparatively very large, thin, elongated, its length slightly exceeding  $\frac{1}{4}$  of the total. The peritoneum is silvery, sparingly dotted with black. In the course of four years ten individuals were obtained at Pinang. They occur-

red singly and at irregular intervals, and varied from two to three inches in length.

GEN. PANCHAX, Valenciennes 1846.\*

Maxillary bone thrown behind the descending branch of the intermaxillary, so that but the lower part contributes to form the angle of the mouth; muzzle broad depressed; gill-openings well cleft; dorsal small, placed far back opposite the anal; intermaxillaries and lower jaw with a narrow band of minute teeth, of which the external series are longer than the rest and arched round the margin of the jaws, so as to appear like cilia; a narrow transversal band of minute teeth on the palate (vomer).

PANCHAX PANCHAX, (Buchan. Ham.)

*Esox panchax*, Buchan. Ham. 211, 380, Pl. III. Fig. 69.

*Aplocheilus chrysostigmus*, McClelland, As. Res. XIX. II. 301 and 426, Pl. XLII. Fig. 2.

*Aplocheilus panchax*, McClelland, *ibid.* 302.

*Panchax buchanani*, Cuv. and Val. XVIII. 383.

Head above, back and upper half of the sides pale silvery green, minutely dotted with black; lower half of the sides and the abdomen silvery white, in some individuals with orange coloured dots; on the occiput a small oval silvery white spot; sides of the head and upper half of opercles silvery green minutely dotted with black, lower half

\* In 1836, Mr. McClelland placed some species of this genus in the family of *Cyprinoidae*, and formed a Subgenus of *Poecilia*, Bl. Schn. to receive them, viz. *Aplocheilus*, (Scr. *Heplocheilus*)—Mr. McClelland characterises the latter as follows: "Intermaxillaries fixed, apices of the jaws flat and directed upwards; five rays in the branchial membrane; fins transparent; a short dorsal placed opposite to the last ray of a long anal; the intestine and stomach form together a small tube scarcely longer than the body; the eyes placed on the edges of the head; the mouth directed upwards; a single row of large teeth inserted along the edges of the lips which are not protractile as in *Poecilia*; the caudal entire." (*Asiatic Researches*, XIX. Pt. II. pp. 301 and 426). Of the preceding eleven characters only four are correct, but they are not sufficient to characterise the genus, viz.: apices of the jaws flat; intestinal canal scarcely longer than the body; eyes on the edges of the head; caudal entire. The remaining characters are either partly incorrect or entirely so. The characters of *Panchax*, Valenciennes, although of a later date than *Heplocheilus*, must therefore be adopted.



white; lower jaw and the throat immediately behind minutely dotted with black, so as to appear like two narrow arched black lines; rest of the throat yellow or white; dorsal hyaline or orange with a large rounded black spot occupying the basal half; in some individuals a small white spot in front of the dorsal, in others the upper margin black; caudal greenish grey minutely dotted with black, upper and lower margin orange edged with black; anal hyaline edged and spotted with orange; ventrals and pectorals yellow. Iris reddish silvery with a blackish ring.

D 9, C 15 $\frac{1}{2}$ , A 17, V 6, P 15, Pr. VI.

HABIT.—*Fresh water Pinang.*

Bengal.

TOTAL LENGTH: 2 $\frac{1}{2}$  inch.

The length of the head is  $\frac{1}{2}$  of the total; the depth at occiput is  $\frac{1}{2}$  of the length of the head. The horizontal diameter of the eye is a little less than  $\frac{1}{2}$  of the head; the distance across the forehead equals two diameters. The nostrils open laterally by two minute apertures placed above each other in front of the anterior orbital margin. There are no lips. The intermaxillaries are very protractile, and are slightly moveable up and down like a lid. Both the external and the internal series of the teeth of the jaws, are a little longer and more distant than the rest of the teeth. Behind the intermaxillaries appears a small crescent-shaped membrane. Behind the latter are some excessively minute teeth placed on a narrow band, which crosses the vomer and forms an arch parallel with the intermaxillary teeth. The tongue is small, fleshy, and as well as the cavity of the mouth dotted with black. The body is covered by 7 longitudinal series of proportionally large scales, with concentric lines and about 13 radial rays. There are about 30 scales in a series between the gill-opening and the caudal. No lateral line is visible, but on each of the anterior 6 to 8 scales of the third series, appears a central impression as if pricked with a needle. The dorsal commences opposite the posterior third of the anal. The ventrals have no filament. It is numerous at Pinang in ponds, paddy fields and ditches. The stomach and intestines form a continued tube, in length scarcely  $\frac{1}{2}$  of the total. The peritoneum is silvery, dotted with black. The number of fin rays given by Buchanan and Mr. McClelland are incorrect.

## ORDO PHYSOSTOMI.

## SUBORDO PHYSOSTOMI ABDOMINALES.

## FAM. SILUROIDÆ.

GEN. BAGRUS, (*Rafinesque*,) Cuvier, 1817.

A band of velvety, or card-like teeth in both jaws ; on the vomer a second, posterior band, either velvety or in a single series.

BAGRUS ABBREVIATUS, Cuv. and Val.

Bagrus abbreviatus, Cuv. and Val. XIV. 420.

Pimelodus abbreviatus, Kuhl and Van. Hasselt, ibid.

Bagrus abbreviatus, Bleeker: Verhand. Batav. Genoots. XXI. 4.

Head above and back dark greenish olive, lighter silvery on the sides ; abdomen silvery white ; fins greenish grey ; their membranes whitish at the base, the rest minutely dotted with black ; adipose fin greenish olive minutely dotted with black ; nasal cirri grey ; maxillary black ; both mandibular pairs white. Iris greenish golden, blackish towards the orbit.

D 17—1 (adipose), C 17½, A 13, V 6, P 1/8 or 9, Br. IX.

Cirri :  $\frac{4}{4}$ HABIT.—*Sea and estuaries of Pinang.*

Java.

TOTAL LENGTH : 1 foot 6 inch.

The length of the head is  $4\frac{1}{2}$  in the total ; the horizontal diameter of the orbit is  $\frac{1}{3}$  of the length of the head ; the distance of the eyes across the head two such diameters. The long helmet is finely shagreened to between the eyes, where its breadth is  $\frac{1}{2}$  of its length ; the occipital point is narrow triangular, occupying half the interval between the occiput and the dorsal spine, and receiving in a notch the point of the second interspinal. The mastoid and suprascapular processes form an elongated arch surrounding the opercle and nearly touching the humeral. The latter is elongated triangular, its length twice its height. The opercle is finely shagreened like the rest of the bones forming the helmet, and has besides some radiating lines. The greatest breadth of the head nearly equals its length, and also the greatest vertical diameter of the body, in front of the dorsal spine. The card-like teeth are disposed on narrow bands in the jaws and on the vomer.

The nasal cirri extend to the preopercle, the maxillary to the point of the ventrals, the external mandibular to the point of the pectorals; the internal are one half of the external. The dorsal spine is rather slender, longitudinally striated, with teeth on the posterior margin, and two or three on the anterior near the apex. The length is  $\frac{3}{4}$  of the first dorsal ray, which is  $\frac{3}{4}$  of the length of the head. The adipose dorsal is as high as the anal, but of half the extent. Each lobe of the furcated caudal equals the head; in young individuals the upper one terminates in a short filament. The pectoral spine is longer and broader than the dorsal; the upper surface is lineated, the margin towards the rays is strongly toothed. At Pinang individuals occur at all seasons, but not in great numbers. They are eaten by the natives.

**BAGRUS SONDAICUS**, Cuv. and Val.

*Bagrus sondaicus*, Cuv. and Val. XIV. 444.

*Bagrus sondaicus*, Bleeker: *Verhandel*, Batav. Genoots. XXI. 4, 14,  
29 and XXII. 5.

Helmet dark olive bronze, (tubercles white,) lighter on the cheeks and opercles; back deep steel-blue with greenish reflections, the sides, to a little beneath the lateral line, lighter, silvery, with from 12 to 15 vertical bands reflecting steel grey or pale golden green; rest of the sides and abdomen silvery white; fins greenish grey minutely dotted with black; external half of pectorals, anal and the lower caudal lobe blackish; maxillary cirri black; external mandibular white at the base, rest black; internal maxillary white. Iris golden green, blackish towards the orbit.

D 17—1 (adipose), C 15 $\frac{1}{2}$ , A 17 or 18, V 6, P 1/10, Br. VI.

Cirri:  $\frac{2}{4}$

**HABIT.**—*Sea of Pinang, Malayan Peninsula.*

Straits of Sunda, Java, Madura.

**TOTAL LENGTH:** 1 foot 9 inch.

The length of the head is  $\frac{1}{4}$  of the total, slightly exceeding the greatest vertical diameter of the body, in front of the dorsal spine. The breadth of the head nearly equals the length. The horizontal diameter of the orbit is  $6\frac{1}{4}$  in the length in the head. The bones forming the helmet are granulated as far as the anterior margin of the orbit, but the small triangular truncated suprascapular is like the opercle

smooth but radiated. The sides of the interspinal form an angle with the centre part, and terminate behind in a blunt point. The interparietal is broad truncated or rounded behind; its length is  $\frac{1}{2}$  of the rest of the helmet, its breadth about  $\frac{1}{3}$ . The humeral is pointed, granulated, triangular, its length  $2\frac{1}{2}$  in the head. The teeth are strong, card-like. Those on the vomer are placed on two small oval spots; those on the palate on two similar but larger, all four forming one series, broader than the maxillary ones. The palatal teeth easily fall out, which renders the fish liable to be mistaken for a species of *Arius*. The maxillary cirri reach to the point of the pectorals; the external mandibular to the base of the pectorals; the internal are  $\frac{1}{3}$  of the external. The dorsal spine is  $\frac{1}{3}$  of the head, granulated on the anterior half of its sides; near the apex the anterior margin carries 4 or 5 small teeth, the posterior 6 or 7 similar ones. The point terminates in a short soft filament, which is easily torn off. The pectoral spine equals the length of the head: the anterior half of the external margin is granulated; the corresponding part of the sides is lineated; the external margin carries near the point a few weak teeth, and similar appear along the internal margin. The point terminates in a soft filament, longer than that of the dorsal. The upper caudal lobe, a little longer than the lower, is  $4\frac{2}{3}$  in the total length. The ventrals are  $\frac{1}{3}$  of the pectorals. The extent of the adipose dorsal is  $\frac{2}{3}$  of the anal. At the origin of the lateral line appear some minute elongated grains; the line itself consists of small tubes which become indistinct after it has passed the dorsal fin. This species is more or less numerous at all seasons. It is eaten by the natives and the air-vessels collected for the China market.

M. Bleeker thinks it probable that *B. javensis*, Cuv. and Val. (XIV. 445) is identical with *B. sondaicus*. [Bleeker l. c., 4(')].

GEN. *ARIUS*, Cuv. and Val. 1840.

Palatal teeth on two distinct separate plates, in some species advancing on the lateral angles of vomer.

*ARIUS TRUNCATUS*, Cuv. and Val.

*Arius truncatus*, Cuv. and Val. XV. 64.

*Arius truncatus*, Bleeker Verh. Bat. Gen. 4.

Head above and back intense blue with silvery reflections, cheeks and opercles golden bronze; throat and sides golden; abdomen silvery white, sparingly dotted with black; fins greyish white minutely dotted with black; margins of dorsal and caudal black; in the adult the posterior half of the caudal and the anal pale lake; adipose pale greyish olive minutely dotted with brown; maxillary cirri black; mandibular pairs white. Iris golden dotted with black.

D 17—1 (adipose), C  $15\frac{1}{2}$ , A 23 or 24, V 6, P  $1\frac{1}{2}$ , Br. VI.

Cirri  $\frac{2}{4}$

HABIT.—*Sea and estuaries of Pinang, Malayan Peninsula.*

Java.

TOTAL LENGTH:  $11\frac{1}{2}$  inch.

The length of the head measured to the point of the opercle is a little less than  $\frac{1}{4}$  of the total, but to the posterior margin of the first interspinal it is  $\frac{1}{3}$  of the total. The latter bone is narrow rectangular, its breadth being  $1\frac{1}{2}$  in its length which is  $\frac{1}{2}$  of the distance to the muzzle. The helmet is granulated and partially striated, its anterior two thirds divided by a longitudinal furrow commencing on the forehead on a level with the nostrils. The cheeks and opercles are veined, and the latter also indistinctly radiated. The anterior half of the head is much depressed, the muzzle rounded, truncated. The teeth of both jaws are on narrow bands, card-like and finer than the palatals, which are crowded on a small oval spot on each side. The cirri are slender: the maxillary ones reach to about the middle of the opercle; the mandibular pairs are nearly equal,  $\frac{2}{3}$  of the former. The eyes are situated at the anterior third of the head, their horizontal diameter is in the young  $\frac{1}{4}$  in the older  $\frac{1}{2}$  of the length of the head; their distance across the forehead is about 4 such diameters. The vertical diameter at occiput is  $\frac{1}{2}$  of the length of the head; that in front of the dorsal is a little less than  $\frac{2}{3}$  of the head. The dorsal spine is strong,  $\frac{2}{3}$  of the length of the head, equalling in length the first ray. The posterior margin and that part of the anterior nearest the apex are finely toothed, the rest is granulated. The pectoral spine is but  $\frac{2}{3}$  of the dorsal which it otherwise resembles, but the teeth of the posterior margin are stronger. The pectorals and ventrals are nearly of equal length or about  $\frac{1}{2}$  of the length of the head. The extent of the anal equals the greatest vertical diameter of the body; the length of the eighth and ninth rays is a little less than that

of the ventrals. The extent of the adipose dorsal is  $\frac{1}{2}$  of the anal, its height  $\frac{1}{2}$  of the longest rays of the latter. The caudal is deeply cleft, the lobes equal, and their length, normally, like the dorsal spine. The lateral line follows the outline of the back at the upper third of the body; arrived at the base of the caudal it continues a short distance obliquely downwards over the three upper rays of the lower lobe. The line consists of little separated tubes, each with a minute downwards pointed process at the posterior part. The two superior branchiostegous rays on each side are very broad and exposed, so as to appear like a subopercle. The stomach is capacious, thin, containing remains of *Crustacea* and mud. The intestinal canal slightly exceeds double the total length. The air-vessel is small but very thick transversely divided in two compartments. The fish is held in esteem by the natives, but at Pinang it is of so rare occurrence that the air-vessel contributes but little to the general stock of Isinglass obtained from other species.

**ARIUS ARIUS, (Buchanan Hamilton.)**

*Pimelodus arius*, Buchan. Ham. 170, 376.

*Arius arius*, Cuv. and Val. XV. 102.

Ikan Salúdu or Surdúdu.

*Adult.* Head above and back intense steel-blue; cheeks, opercles and sides greenish golden or bronze; throat and abdomen white slightly dotted with black; dorsal greyish white minutely dotted with black; filament of the spine and the upper margin black; caudal yellowish white minutely dotted with brown; anal and pectorals white, external half so closely dotted with black as to assume that colour; ventrals hyaline, closely dotted with brown; adipose pale greyish olive with a large black spot, posterior margin white; maxillary cirri blackish; mandibular pairs white. Iris greenish golden, orbital margin blackish.

*Young.* Dorsal, posterior half of caudal, middle of anal and base of adipose pale lake.

D  $1\frac{1}{7}$ —1 (adipose), C  $15\frac{3}{4}$ , A 18 to 21, V 6, P  $1\frac{1}{10}$ , Br. V.

Cirri  $\frac{2}{4}$

**HABIT.**—*Sea and estuaries of Pinang, Malayan Peninsula, Singapore.*

Pondicherry, Gangetic estuaries.

**TOTAL LENGTH:** 1 foot 10 inch.

The length of the head is  $\frac{1}{4}$  of the total. The helmet is granulated to the middle above the orbit. The first interspinal is rectangular nearly square, its length  $\frac{1}{4}$  of the distance to the muzzle; the posterior margin is notched, receiving a broad point from the crescent-shaped second interspinal. The anterior two thirds of the helmet are divided by a broad longitudinal furrow. The interopercle and opercle are radiated, the point of the latter indistinctly granular. The horizontal diameter of the orbit is  $\frac{1}{4}$  of the length of the head. The teeth of the jaws are card-like, on narrow bands. Those of the palate are granular, placed on two close oval spots. The maxillary cirri do not quite reach to the apex of the pectoral spine; the external mandibular pair is  $\frac{1}{2}$  shorter; the internal is  $\frac{1}{2}$  of the external. The vertical diameter in front of the dorsal slightly exceeds the length of the head, and equals the length of the dorsal spine. The latter is very strong, the posterior margin and the anterior near the apex are toothed, the rest is coarsely granulated. To the apex is attached a soft filament, seldom exceeding  $\frac{1}{2}$  the length of the spine. The pectoral spine resembles the former, but it is slenderer, shorter by  $\frac{1}{4}$ , and without filament. The extent of the adipose is  $\frac{1}{2}$  of that of the anal; its height  $\frac{1}{2}$  of the length of the sixth and seventh rays, which is  $\frac{1}{2}$  of the head. The caudal lobes equal the length of the head. The lateral line resembles that of *Arius truncatus*, but it keeps nearer to the middle of the body. At Pinaug smaller individuals of this species are very numerous at all seasons. They form an article of food, and contribute more than any other of the *Siluroideæ* to the exportation of Isinglass.

#### ARIUS MILITARIS, (Linné.)?

*Silurus militaris*, Linné: Syst. 1356.?

*Arius militaris*, Cuv. and Val. XV. 114, Pl. 430.

*Osteogeneiosus*\* Bleeker: Verhandel. Batav. Genootsch. XXI. 49.

Head above and back bottle-green bronze, lighter on the sides of the head and body; abdomen silvery white, anterior half minutely dotted with brown; dorsal and caudal pale greyish olive, minutely dotted with

\* *OSTEOGENEIOSUS*, Bleeker, 1847, (Scrib. *OSTEOGENIUS*.) Teeth on the anterior part of the palate disposed in two oblong arched groups; two supra-maxillary bony, rigid cirri; branchiostegous rays five. Otherwise resembling *Arius*.

black, margin blackish; rest of the fins white; upper half between anterior four rays of ventrals dotted with black; upper surface of pectorals and posterior half of lower black, in the axilla a black spot along the root of pectorals; jaws and root of the long cirrus-like maxillary prolongation blackish bronze, rest of the latter reddish white; adipose fin greenish olive dotted with black, posterior margin white. Iris greenish golden dotted with black.

D 17—1 (adipose), C 15½, A 21, V 6, P 1½, Br. V.

Cirri  $\frac{2}{0}$

**HABIT.**—*Sea and estuaries of Malayan Peninsula and Islands.*

Sea and estuaries of Malabar, Coromandel; estuaries of Ganges and Irawaddy.

**TOTAL LENGTH:** 1 foot 6 inch.

The length of the head is  $4\frac{1}{2}$  in the total. It is completely covered by smooth skin, and but a few granulations appear on the anterior part of the elliptic interparietal. The rest of the bone, like the opercles, is radiated; it occupies  $\frac{1}{4}$  of the distance from the muzzle. The horizontal diameter of the eye is  $\frac{1}{2}$  of the length of the head; the distance across the forehead is about three such diameters. The card-like teeth of the jaws are on broad bands; that of the upper one is the shorter, as it does not reach to the angle of the mouth, but terminates at the root of the bony cirrus-like elongation of the upper maxillary bone. The latter is slender, elastic, flattened with a shallow furrow on each side; its length equals the head; the anterior sixth is attached to the side of the head by a small triangular membrane which is, however, too short to admit of the bone being projected at a right angle. The palatal teeth are granular, placed in two separated groups of an irregular rhomboidal shape. The vertical diameter of the body, in front of the dorsal, is  $\frac{2}{3}$  of the length of the head. The dorsal spine is slender, the lower half of the anterior margin is finely granulated, the upper half and the posterior margin are very finely toothed; it is a little shorter than the first ray which is  $\frac{2}{3}$  of the length of the head. The pectoral spine resembles the dorsal and is but a little shorter. The extent of the anal is  $\frac{1}{2}$  of the length of the body; the eighth, the longest ray, slightly exceeding  $\frac{1}{2}$  of the extent. The extent of the adipose fin is about  $\frac{1}{2}$  of the anal, but of nearly equal height. The caudal is



slightly cleft, and the lobes a little rounded; their length is  $\frac{1}{4}$  of the total. The lateral line resembles that of *Arius truncatus*. At Pinang single individuals occur at all seasons; they are eaten by the natives, and their air-vessels preserved.

GEN. PIMELODUS, (*Lacépède*, 1803,) *Cuv. and Val.* 1840.

Palate smooth, without teeth; six or eight cirri; with or without helmet.

**PIMELODUS PECTINIDENS, Cantor.**

*Young?* Head above and back yellowish green bronze, dotted with black; between the anterior points of the helmet an oval yellowish white spot, cheeks, opercles and sides of the body silvery; the two first minutely dotted with black; throat and abdomen white; fins, including the adipose, yellowish white; maxillary cirri black; mandibular pairs white. Iris golden minutely dotted with black.

D 17—1 (adipose), C 15 $\frac{1}{2}$ , A 20, V 6, P 1/8, Br. IV.

Cirri  $\frac{2}{4}$

**HABIT.**—*Freshwater, Pinang.*

**TOTAL LENGTH:** 4 $\frac{1}{2}$  inch.

The greatest vertical diameter of the body, in front of the dorsal fin, is  $\frac{1}{4}$  of the total length; from thence the profile descends in a nearly straight line to the rounded muzzle. To the point of the opercle the length of the head is  $\frac{1}{4}$  of the total, but to the point of the interparietal bone it is 3 $\frac{1}{2}$ . Above the head is depressed, transversely arched, its greatest breadth at the occiput is  $\frac{1}{4}$  less than its length. The interparietal is triangular truncated, its length  $\frac{1}{4}$  of the distance to the muzzle, its breadth at the base equals its length; the truncated apex is notched, receiving the point of the second interspinal. The whole of the helmet is finely granulated to above the posterior margin of the orbit. It is longitudinally divided by a furrow terminating a little behind the anterior half of the distance between the muzzle and the dorsal. The suprascapular bone is narrow, pointed, and joins the equilateral triangular humeral. Both as well as the opercles are rough and striated. The size of the opercle equals that of the preopercle and interopercle together. The cheeks are smooth. The mouth is large, the angle reaching to the posterior margin of the orbit; the fleshy

lips completely hide the teeth; the upper jaw projects beyond the lower. In each jaw appears a single series of closely set, small, flattened teeth, resembling a fine comb. To the naked eye the apex of the teeth appears to be truncated, trenchant, but under a lens it is bluntly trilobate. The cirri are very fine: the maxillary reach to the preopercle, the mandibular pairs are so short as to easily escape observation. The nostrils open closely in front of the orbit. The latter occupies the second fourth of the head, a little nearer to the jaw than to the forehead; the greatest diameter, obliquely downwards, is a little less than  $\frac{1}{4}$  of the length of the head. Of the four branchiostegous rays, the two upper ones are longer and broader than the lower. The dorsal spine is strong and nearly as long as the head, the two sides are striated, the lower half of the anterior margin is granulated, the upper half of this and of the posterior margin is finely toothed; the first ray is a little longer than the spine. The pectoral spine is a little shorter than the dorsal, which it otherwise resembles. The ventrals are  $\frac{2}{3}$  of the length of the head. The extent of the base of the anal is  $\frac{1}{2}$ , the eighth ray  $\frac{2}{3}$  of the length of the head. The adipose dorsal fin is placed opposite the middle of the anal; its base and length are  $\frac{1}{2}$  of the latter. The posterior margin of the caudal is nearly crescent-shaped; the upper lobe slightly longer than the lower, is  $4\frac{1}{2}$  in the total length. The lateral line resembles that of *Arius truncatus*. A single individual was observed at Pinang in August 1844. The yellowish white oval spot on the forehead is in some other *Siluroideæ* characteristic of immaturity. It may perhaps also be so in this species, notwithstanding the worn appearance of the trilobate teeth.

GEN. CLARIAS, (Gronov. 1763,) Valenciennes, 1840.

(COSSYPHUS, McClelland, 1843.\*—PHAGORUS, McClelland, 1844.)

Head with a long, granular helmet, formed by the cranial and supra-

\* Sir John Richardson in his Report, 1845, p. 237, observes, that "*Cossyphus ater*, McClelland, (Calcutta Journ. IV. p. 403, Pl. 22, Fig. 3,) is apparently an injured example of this genus," (*Plotosus*, apud Richardson.)

*Cossyphus ater*, McClelland, is founded upon a mutilated specimen of either *Clarias jagur*, (*Macropteronotus jagur*, Buch. Hamilton, 145, 374,) or upon a closely allied species, but more probably upon the former. Mr. McClelland later substituted *Phagorus* for *Cossyphus* (Calcutta Journ. V. 225, Errata).

scapular bones; the interparietal advancing on the occiput as a more or less soft lamina, supported by the occipital crest; card-like or granular teeth on the vomer; dorsal without spine, occupying nearly the whole of the back; anal less extensive; margin of pectoral spine minutely toothed; on each side two ramified branchial appendages; branchiostegous rays 9 to 11.

**CLARIAS PUNCTATUS, Cuv. and Val.**

*Clarias punctatus*, Cuv. and Val. XV. 384.

*Clarias punctatus*, Bleeker: Verhandel. Bat. Genoot. XXI. 4, 17, 53.

Head, body, fins, and cirri blackish brown; with purple or lilac reflections; body either uniformly so or with large irregular lighter spots, with eight to ten vertical series, each consisting of four to six whitish dots, in number and distribution liable to individual variations; pectoral spine, throat, and abdomen as far as the ventrals, brownish white. Iris dark brown.

D 70, C 17 $\frac{1}{4}$ , A 51 to 53, V 6, P 1 $\frac{1}{8}$ , Br. IX.

Cirri  $\frac{4}{4}$

**HABIT.**—*Estuaries and freshwater, Pinang.*

Java.

**TOTAL LENGTH:** 10 inch.

Measured to the apex of the interparietal, the head slightly exceeds  $\frac{1}{4}$  of the total length, (to the point of the opercle it is  $\frac{1}{3}$ ); the breadth between the gill-openings is  $\frac{2}{3}$  of the length. The eye is situated at the anterior fourth, its horizontal diameter is  $\frac{1}{3}$ , and the distance across the forehead is  $2\frac{1}{2}$  in the length of the head to the apex of the interparietal. The latter is triangular with the apex rounded, the base double the length, which is  $\frac{1}{3}$  of the distance to the muzzle. In the centre of the helmet appear two ovoid apertures, covered by the integuments: the anterior is  $\frac{1}{3}$ , the posterior  $\frac{1}{10}$  of the length of the head. The maxillary cirri slightly exceed  $\frac{1}{4}$  of the total length, nearly reaching to the apex of the pectoral spine; the nasal are  $\frac{1}{3}$ , the outer mandibular  $\frac{1}{3}$ , and the inner mandibular  $\frac{1}{3}$  of the total length. The teeth are card-like: those of the upper jaw on a broad band, reaching to the root of the maxillary cirri; those of the vomer and palate forming a narrow crescent. The dorsal fin commences at a distance from the apex of the interparietal, equalling  $\frac{1}{4}$  of the length of the head. The pectoral spine

is strong, like a sabre: the surfaces finely striated, the outer margin finely granulated with two or three teeth near the apex, the inner finely toothed; the length of the spine is  $7\frac{1}{2}$  in the total; the first rays are a little longer. The ventrals are situated at the anterior third of the total length, in which they are contained  $10\frac{1}{2}$  times. Between the anus and the anal fin appears a short conical appendage. The length of the caudal is  $7\frac{1}{2}$  in the total. The stomach is a short rounded sac, the intestinal caudal is about  $\frac{1}{2}$  of the total length; the liver is divided in two short lobes; the left is again subdivided in two; the gall is oval, large; the spleen is small, flattened, oval. The posterior branchial appendage is large, nearly double the size of the anterior. This species is numerous at all seasons. It is eaten by the poorer classes of natives.

GEN. *Plotosus*, Lacépède, 1803.

Body elongated, terminating in a compressed point; two dorsals, of which the second, caudal and anal united; head naked; strong conical teeth in the jaws and vomer; eight short cirri; behind the conical anal papilla a small ramified appendage.

*Plotosus anguillaris*, (Bloch.)

Renard, I. Pl. III. Fig. 19. Sambalang.

Valentyn, No. 496, Ikan binara.

Silurus arab, Forskål, XVI. No. 36?

Platystachus anguillaris, Bloch, Tab. 373, Fig. 1.

Plotosse anguillé, Lacép. V. Pl. III. Fig. 2.

Russell, CLXVI. Ingeelee.

Platystachus anguillaris, Shaw, V. 30, Pl. 99.

Krusenstern: Voyage, Pl. LX. Figs. 12 and 13.

Duperrey: Voyage, Poiss. Pl. XXXI. Fig. 3.

Plotosse ikapou, Lesson: Dict. Class. d'Hist. Nat. XV. 435.

Plotosus anguillaris, Cuv. R. A. II. 297(?).

Plotosus marginatus, Bennett: Life of Raffles.

Plotosus anguillaris, Rüppell: Neue Wirb. Fische, 76.

Plotosus vittatus, } Swainson, II. 307.

Clarias anguillaris, }

Plotosus lineatus, Cuv. and Val. XV. 412.

Plotosus lineatus, Richardson: Report, 1845, 286.

*Plotosus lineatus*, Temm. et Schl. Fauna Jap. Pisc. 228, Pl. CIV.

Fig. 3.

*Plotosus lineatus*, Bleeker : Verh. Bat. Gen. XXI. 4, 17, 57.

Similang károng of the Malays.

*Young.* Head above and back blackish olive, lighter or copper coloured on the sides of the head and body ; two white bands along the body : one from the muzzle above the eye along the back, a second, broader, from the maxillary cirrus, and in some a third from the ventrals ; lips, throat and abdomen white ; fins pale brownish olive or lake, dotted and edged with black ; upper part of first dorsal with a black spot ; anal papilla and ramified appendage crimson ; nasal and maxillary cirri blackish ; mandibular pairs white. Iris golden dotted with black.

*Adult.* The lateral white bands indistinct.

1st D  $1\frac{1}{4}$ ,—2d D, C and A 172 or 173, V 13 or 14, P  $1\frac{1}{11}$ ,

Br. XI or XII.—Cirri  $\frac{4}{4}$

HABIT.—*Sea and estuaries of Malayan Peninsula and Islands.*

Isle of France, Society- and Friendly Islands, Japan, Philippines, China Seas, Amboyna, Celebes, Java, Seychelles, Red Sea, Malabar, Ceylon, Coromandel, Western Australia.

TOTAL LENGTH : 10 inch.

The length of the head is  $5\frac{1}{2}$  in the total, its depth at occiput  $\frac{1}{2}$  of the length. The horizontal diameter of the eye is  $\frac{1}{2}$  of the length of the head ; the distance across the forehead 2 such diameters. The greatest vertical diameter of the body, in front of the first dorsal, is  $\frac{1}{2}$  of the total length. The maxillary and external mandibular cirri are equal, both pairs less than  $\frac{1}{2}$  of the length of the head. The nasal and internal mandibular pairs are shorter. This species is very numerous at all seasons. In the stomach of those dissected was found *Modiola faba*, Benson, a very small bivalve inhabiting the Malayan estuaries.

*PLOTOSUS ALBILABRIS*, Cuv. and Val.

*Plotosus albilabris*, Cuv. and Val. XV. 427.

*Plotosus albilabris*, Bleeker : Verh. Bat. Gen. XXI. 4.

Similang of the Malays.

*Young.* Head above and back blackish olive, lighter on the sides of the head (cheeks pale bluish), and of the body above the lateral line; beneath the latter, the throat and abdomen impure bluish white; lips pale blackish; body everywhere closely dotted with brown; pectorals blackish above, whitish beneath; rest of the fins pale greyish olive minutely dotted and edged with black; cirri blackish, root of mandibular pairs whitish; anal papilla and ramified appendage crimson. Iris golden dotted with brown.

1st D  $1\frac{1}{4}$ , V 13, P  $1\frac{1}{9}$ , Br. XII.—Cirri  $\frac{4}{4}$

M. M. Cuvier and Valenciennes count: 2d D 109, C 11, A 97,  
(total: 217).

HABIT.—*Sea and estuaries of Pinang, Malayan Peninsula.*

Batavia.

TOTAL LENGTH:  $6\frac{1}{4}$  inch.

The length of the head is  $\frac{1}{3}$  of the total; the depth at occiput little more than  $\frac{1}{4}$  of the head. The horizontal diameter of the eye is  $\frac{1}{4}$  of the head, the distance across the forehead two such diameters. The nasal cirri are a little longer than the head, the maxillary a little shorter and slenderer, the outer mandibular are  $\frac{2}{3}$  of the latter, the inner pair slightly shorter. M. M. Cuvier and Valenciennes describe the maxillary cirri as  $\frac{1}{3}$  shorter than the nasal, but the outer mandibular pair as long as the latter. All the teeth are strong, conical. The greatest vertical diameter in front of the first dorsal is  $\frac{1}{4}$  of the total length. The dorsal spine is  $\frac{1}{3}$  of the length of the head and but little shorter than the first ray. The pectoral spine is slenderer than the dorsal, the first ray slightly exceeds  $\frac{1}{3}$  of the length of the head. The ventrals are  $\frac{1}{3}$  shorter than the pectorals. The caudal is oval, rounded. The lips are fleshy and papillular. Minute papillæ appear here and there on the body. The conical anal papilla is rather large, and the ramified appendage longer and with a greater number of branches than in *P. anguillaris*.—At Pinang, the present species is less numerous than the former. The wounds of both are equally dreaded, and both are eaten by the poorer classes of natives.

FAM. CYPRINOIDÆ.

GEN. CAPOETA, Cuv. and Val. 1842.

Third bony dorsal ray toothed; a filament at the angle of the mouth; body compressed, covered with large scales.

**CAPOETA MACROLEPIDOTA, Kuhl and Van Hasselt.**

*Capoeta macrolepidota*, Cuv. and Val. XVI. 280, Pl. 477, (*Young*.)

*Adult*. Head above brownish olive; back silvery greenish olive, lighter on the upper half of the sides, the rest and abdomen light golden; all the scales edged with pale brown, some with a pale dark spot at the root; the oblique series in front of the dorsal fin greenish olive, forming a dark obliquely backwards-directed band, interrupted by the lateral line; opercles and cheeks shining iridescent silvery; between the eye and the angle of the mouth a blackish blue triangular spot terminating in lines radiating towards the preopercle; lips and cirri minutely dotted with black; fin-membranes transparent; rays buff minutely dotted with black: the three first dorsal, and the first pectoral blackish; caudal with a broad blackish brim above and below. Iris golden, upper orbital half black.

*Young*. Differs from the adult in having the dark oblique band in front of the dorsal more distinct and reaching to the abdomen; cheeks uniformly silvery without any spot.

D  $3/8$ , C  $19\frac{1}{2}$ , A  $2/5$  or 6, V  $2/8$ , P 16, Br. III.

HABIT.—*Freshwater, Pinang.*

Java, Tenasserim.

TOTAL LENGTH: 11 inch.

The length of the head is  $4\frac{1}{2}$  in the total; the depth at occiput  $\frac{2}{3}$  of the length of the head. The eye, bordering on the profile, occupies the second fourth of the head, that being the length of its horizontal diameter; the distance across the forehead is  $1\frac{1}{2}$  diameter. The opercles and cheeks are naked. Four large infraorbitals surround the orbit. From the temple round the lower margin of the orbit over the infra-orbital proceeds a tube, which sends downwards several shorter ones. The openings of the nostrils are situated close in front of the eye: both are separated by a projecting fleshy septum. The lips and tongue are fleshy; on the symphysis of the lower jaw appears a small protuberance. Behind both jaws appears a crescent-shaped fold of the membrane lining the mouth. The small filament at the angle of the mouth is  $\frac{2}{3}$  of the horizontal diameter of the eye. The greatest vertical diameter of the body, in front of the dorsal, is  $4\frac{1}{2}$  in the total length. The sides are covered by 7 longitudinal series of large rhom-

bic scales, of which there are 27 or 28 on the lateral line. The latter consists of a simple tube on each scale, of which the anterior five of the series deviate obliquely downwards, the rest, (on the third series from below,) proceed straight to the caudal. All the scales have from 4 to 10 backwards radiating lines. The first dorsal ray is excessively short; the third, the longest, is  $\frac{3}{4}$  of the length of the head and has a few minute teeth in the middle of the posterior margin; the caudal lobes equal the length of the head; the length of the anal and ventrals is  $\frac{1}{2}$  of the latter; the first ventral ray is short and very slender; the length of the first pectoral ray, which has a few teeth on the outer margin near the root, equals that of the first dorsal. The latter is represented a little too short in the otherwise correct figure of M. M. Cuvier and Valenciennes. At Pinang the fish is not numerous. It is of good flavour. It rises to insects, remains of which were found in the stomach. The length of the intestinal canal exceeds by  $\frac{1}{2}$  the total; the stomach as well as the intestines are very thin. The air-vessel is very large, thin, white, consisting of two elongated oval portions, of which the anterior is truncated in front.

GEN. LEUCISCUS, *Rondelet*, 1554.

SUB GEN. LEUCISCUS, *Valenciennes*, 1844.

Neither spines nor cirri; dorsal and anal fins short.

LEUCISCUS RASBORA, (Buchan. Ham.)

*Cyprinus rasbora*, Buchan. Ham. 329, 391, Pl. II. Fig. 90.

*Leuciscus rasbora*, Cuv. R. A. II. 276 (\*).

*Leuciscus rasbora*, McClelland: As. Res. XIX. 292 and 407.

*Cyprinus* (*Leuciscus*) *rasbora*, Cuv. and Val. XVI. 438.

Head above, back and upper part of the sides yellowish green, the root and edges of the scales minutely dotted with black; along the middle of the side a longitudinal golden stripe, bordered beneath by an indistinct bluish black one; lower half of the side and abdomen silvery pale yellow; cheeks and opercles shining silvery, the latter with blue reflections dotted with black; caudal pale yellowish dotted with black, posterior margin blackish; rest of the fins whitish transparent. Iris silvery, orbital margin bluish dotted with black.



D 9, C 19½, A 8, V 9 or 10, P 13, Br. III.

HABIT.—*Freshwater, Pinang.*

*Freshwater, Bengal, Upper Assam.*

TOTAL LENGTH : 4½ inch.

The length of the head is 4½ in the total. The eye is situated a little in front of the second third of the head, bordering on the profile, its horizontal diameter is 3½ in the length of the head, the distance across the forehead is 1½ diameter. The cavity of the mouth is minutely dotted with black. As observed by Buchanan, the lower jaw terminates in a point, surmounted by a small tubercle which fits into a corresponding notch of the upper jaw. But of a number examined at Pinang none presented three prehensile knobs on the lower jaw, as described by Mr. McClelland in a specimen collected in Upper Assam by the late Mr. Griffith. The greatest vertical diameter of the body, in front of the dorsal, slightly exceeds the length of the head. The sides are covered by 7 longitudinal series of large rounded scales, each with a number of lines radiating from the root. A straight line from the gill-opening to the caudal contains 23. The lateral line proceeds obliquely downwards to near the termination of the pectoral fin, from whence it continues on the sixth, the penultimate series of scales, straight to the caudal. The first dorsal ray is situated a little behind the second half of the distance between the muzzle and the caudal, opposite the posterior ventral ray. The second dorsal ray, the longest, nearly equals the first pectoral ray, both are about ¾ of the length of the head. The lower caudal lobe, a little longer than the upper, slightly exceeds the length of the head. The first ventral and the second anal ray are nearly equal, a little shorter than the second dorsal ray. At Pinang this species is numerous in rivulets and in rice fields, when they are flooded.

#### FAM. SCOPELINOIDÆ.

GEN. SAURUS, *Cuvier*, 1817.

(HARPODON, *Lesueur*, 1825.—LAURIDA, [*Aristoteles*], *Swainson*, 1839.—TRIURUS, *Swainson*, 1839.)

Muzzle short; mouth extending far behind the eyes; edge of upper jaw entirely formed by the intermaxillaries; numerous pointed teeth

in both jaws, on the palatals, tongue and pharyngeals, but none on the vomer;\* anterior dorsal a little behind the large ventrals; body, cheeks and opercles scaly; from 8 to 15 branchiostegous rays.

**SAURUS BADI, Cuvier.**

Russell, CLXXII. Badi Mottah.

*Saurus badi*, Cuv. R. A. II. 314<sup>(1)</sup>.

*Saurus badimottah*, Rüppell: Neue Wirbelth, Fische, 77.

Head above, back and sides above the lateral line dull greenish olive, or greyish green; rest of the body pale silvery white; cheeks and opercles pale silvery olive with rose-coloured and bluish reflections; dorsal rays pale yellowish, membrane hyaline minutely dotted with black; second dorsal pale flesh-coloured, anterior margin blackish; caudal yellowish, minutely dotted with black, posterior half blackish; anal and ventral rays pale yellowish, membrane hyaline; pectorals pale yellowish, posterior half blackish. Iris silvery olive.

D 11 or 12—1 (adipose), C 19½, A 10 or 11, V 9, P 15, Br. XII, XIII, or XIV.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Singapore.*

Coromandel.

**TOTAL LENGTH:** 1 foot.

The length of the head is  $\frac{1}{2}$  of the total. The horizontal diameter of the orbit is  $4\frac{1}{2}$  in the length of the head; the distance across the forehead, as well as the distance from the orbit to the muzzle, equals one diameter. The eye is covered by a broad, transparent adipose membrane with a circular pupillary aperture. The angle of the mouth is situated at the posterior third of the head. The teeth of both jaws are placed in 5 to 6 series, of which the internal one carries the longest and most distant teeth; the rest gradually decrease in length towards the external series of teeth which are minute, card-like and erect, not obliquely forwards pointed like the rest. With the exception of the anterior four or five anterior teeth of each palatal, the rest as well as the pharyngeals, hyoid and lingual teeth are all smaller and pointing backwards. On the vomer appears a double series of excessively minute pointed teeth, forming a short transversal line which unites

\* *Saurus badi* has a few minute teeth on the vomer.

the palatal series. The teeth of the vomer are deciduous, and may from their diminutive size easily escape observation. The vertical diameter at occiput is  $\frac{1}{11}$ , in front of the anterior dorsal  $\frac{1}{4}$ , and at the root of the caudal  $\frac{1}{16}$  of the total length. The sides are covered by 11 longitudinal series of rounded, finely concentrically striated scales, with 3 radiating lines at the radical part. Each scale has a central rather obsolete keel. The lateral line occupies the sixth series which is a little nearer to the back than to the abdomen. It contains upwards of 60 scales, triangular, a little smaller than the rest, each with a small trifid tubercle in front of the central keel, which is sharper than that of the rest of the scales and forms a continued ridge. The latter becomes very marked behind the second dorsal, so as to resemble that of the *Scombroidea*. The anterior dorsal occupies the middle of the back between the muzzle and the caudal; the second ray is the longest,  $\frac{2}{3}$  of the length of the head; of which the extent of the base is  $\frac{1}{2}$ . The ventrals are placed in front of the preceding fin; the first ray commences in the centre between the muzzle and the first anal ray; the penultimate ray, the longest, is  $\frac{2}{3}$  of the length of the head; outside the root of the fin appears an elongated scale,  $\frac{2}{3}$  of the longest ray. The first anal ray commences opposite the centre, between the last dorsal ray and the root of the caudal; the second ray, the longest equals the extent of the base which is  $\frac{1}{2}$  of the length of the head. The second small adipose dorsal is placed opposite the two posterior anal rays. The caudal is covered with minute scales; the upper lobe, which is generally a little longer than the lower, equals the length of the head. The length of the pectorals is  $\frac{1}{2}$  of that of the head; in the axilla appears a short broad triangular scale. Single individuals occur at Pinang at all seasons. They are eaten by the natives, although they are reputed to be very insipid.

*SAURUS TRACHINUS*, Temminck and Schlegel.

*Saurus trachinus*, Temm. et Schl. Fauna Japon. Pisces,  
231, Tab. CVI. Fig. 2.

*Young*. Head above, back and sides above the lateral line light greenish olive, rest of the body silvery white; above the lateral line three parallel light blue longitudinal bands; beneath the line three or four similar but paler bands, all commencing at the gill-opening, termi-

nating at the root of the caudal; behind the posterior margin of opercle an oblique black spot terminating at the root of the pectoral; cheeks and opercles silvery light greenish olive, with light blue and rose-coloured reflections; caudal bright yellow; adipose dorsal pale yellowish olive; rest of the fins hyaline, anterior dorsal and ventral rays pale yellowish. Iris silvery light greenish olive.

D 12 or 13—1 (adipose), C 19 $\frac{1}{2}$ , A 15 or 16, V 8, P 12, Br. XII.

HABIT.—*Sea of Pinang.*

Japan.

TOTAL LENGTH: 6 inch.

The head bears a general resemblance to the Gen. *Trackius*, Linné; the upper surface is scaleless, and like the infraorbitals full of minute radiating asperities; the central line of the head is smooth, and forms a narrow sulcus between the orbital arches. The length of the head is  $4\frac{1}{2}$  in the total length. The horizontal diameter of the orbit is  $\frac{1}{2}$  of the length of the head, the distance of the orbit from the muzzle is  $\frac{1}{2}$  diameter, of which the distance across the forehead is  $\frac{1}{2}$ . The angle of the mouth is situated a little behind the anterior half of the head. In each jaw appear but two series of teeth; in other respects the dentition is similar to that of *S. badi*, but there are no teeth on the vomer. The subopercle, the largest, is rounded, membranous behind, and sends a narrow pointed process up between the triangular opercle and the narrow crescent-shaped preopercle; the interopercle is triangular and but little smaller than the opercle. The vertical diameter at occiput is  $6\frac{1}{2}$ , at the anterior dorsal  $\frac{1}{2}$ , and at the root of the caudal  $15\frac{1}{2}$  in the total length. The body is covered by 11 longitudinal series of scales resembling those of *S. badi*, but those immediately behind the occiput have near the posterior margin some radiating short furrows. The lateral line occupies the fifth series, and contains upwards of 60 scales; those of the anterior half of the line consist of a small tubercle terminating in 4 to 8 digitations; the rest are simple, tubular. The line itself is much less raised than in *S. badi*. The first ray of the anterior dorsal is a little nearer to the muzzle than the last dorsal ray is to the root of the caudal. The third ray, the longest, is  $\frac{2}{11}$  of the head and equals the extent of the base, of which the posterior ray is a little more than  $\frac{1}{2}$ . The ventrals are placed in front of the anterior dorsal; the first ray, the shortest, commences in the centre between the muzzle and the first

anal ray; the sixth ray is the longest, equalling the third dorsal ray; the root of the fin is on each side enclosed by an elongated scale,  $\frac{1}{2}$  the length of the sixth ray. The first anal ray is placed much farther forwards than in *S. badi*: it commences in the centre between the first ventral ray and the root of the caudal. The rays are nearly equal, or about  $\frac{1}{2}$  of the extent of the base, which is but little shorter than the head. The minute adipose dorsal is placed at the posterior third of the distance between the last dorsal ray and the root of the caudal, opposite the posterior fifth of the anal. The caudal is but slightly cleft; each lobe equals the third dorsal ray. The pectorals are short triangular, slightly exceeding  $\frac{1}{2}$  of the head. The stomach is capacious, cylindrical,  $\frac{1}{2}$  of the total length; its contents shrimps. The intestinal canal is a simple narrow tube, a little less than  $\frac{1}{2}$  of the total length; from pylorus commences a single series of 15 linear appendicula cœcopylorica, each about  $\frac{1}{12}$  of the length of the intestinal canal. Two individuals, of 5 and 6 inches in length, occurred together at Pinang in February 1845. The fishermen were not acquainted with the species.

(HARPODON,\* *Lesueur*.—TRIURUS,† *Swainson*.)

SAURUS NEHEREUS, (Buchanan Hamilton.)

Russell CLXXI. Wana Motta, (*Adult*.)

Osmerus? nehereus, Buch. Ham. 209, 379, (*Adult*.)

Salmo (Harpodon) microps, Lesueur: Journ. Philad. Acad. V.  
48, Pl. III. (*Young*.)

Saurus ophiodon, Cuvier, R. A. II. 314, (*Adult*.)

Laurida microps, Swainson, I. 246, Fig. 49, (*Young*.)

Harpodon microps, Swainson, II. 288, Vol. I. Fig. 49.

Triurus microcephalus, Swainson, II. 288, (*Adult*.)

Bummaloh, or Bombay Duck, Cantor: Journ. R. A. Soc.  
V. 168.

\* Founded upon a mistake, pointed out by Cuvier, R. A. II. 314 (\*).

† Preoccupied by *Triurus*, Lacépède, 1800, (*Muranoidæ*.) Mr. Swainson's genus is founded upon Russell's No. CLXXI. Wana Motta, which is identical with *Harpodon microps*, Lesueur, quoted by Mr. Swainson as a distinct species.

Royle : On the Prod. of Indian Isinglass, 65.

Saurus nehereus, Richardson : Report, 1845, 301.

Saurus ophiodon, Bleeker : Verh. Batav. Gen. XXII. 6.

Láli of the Malays.

Head above, back and sides light grey or dust-coloured, hemitransparent like gelatine, with minute starlike black and brownish dots; anterior part of abdomen pale silvery bluish; rest whitish; cheeks and opercles pale silvery bluish, dotted like the body; fins transparent, coloured like the body but more closely dotted, so as to appear pale blackish. Iris bluish silvery minutely dotted with black.

D 12 or 11—1 (adipose), C  $19\frac{1}{2}$ , A 14 or 15, V 9, P 11 or 12,

Br. XXIV or XXIII.

HABIT.—*Sea of Malayan Peninsula and Islands.*

Chusan, Woosung, Canton, Madura, Java, Sumatra, Tennasserim, Mouths of the Ganges, Vizagapatam, Bay of Bengal, Bombay, Malabar.

TOTAL LENGTH : 11 inch.

Measured obliquely from the muzzle to the posterior angle of the opercle, the length of the head is  $\frac{1}{4}$  of the total. The diameter of the eye is  $\frac{1}{8}$  of the length of the head; the distance from the muzzle is 2 diameters; that across the arched forehead 4. The angle of the mouth is at the posterior fourth of the length of the head; the jaws are equal. All the teeth are excessively slender, recurvous, and, like those of some of the *Gobioidæ*, erectile, but not flexible. They may be raised or laid down in the manner in which Cuvier describes the teeth of his genus *Salarias*, like the keys of a Piano. Those of the jaws and some of the palatals have a single barb at the posterior margin of the point; a few of the former are arrow-shaped. In both jaws appear three series of somewhat distant teeth: the external consists of excessively minute ones, the second of longer, and the internal series of the longest of all. Those of the lower jaw are longer than those of the upper, particularly three or four on each side of the symphysis. The pharyngeal and palatals consist of two series. The fourth anterior tooth of each palatal is very long. The tongue is very short, linear, and covered with fine teeth, like those of the hyoid bone and the upper margin of the branchial arches. The opercles are membranous, diaphanous and appear all blended together. The branchiostegous mem-

brane is narrow, but it projects behind the posterior radiated angle of the opercle. The branchiostegous rays are excessively slender and flexible like hairs, and they gradually increase in length backwards. The posterior ones may be seen through the lower part of the opercle. The nostrils open vertically in front of the anterior margin of the orbit; the anterior opening is the larger. The upper part of the head is arched from side to side, and cellular, covered by a thin membrane, and like the rest of the head and body by diaphanous, deciduous scales. The latter are of moderate size, oval with concentric rings. The lateral line, a little nearer the back than the abdomen, is slightly raised or keeled, and consists of about 44 rectangular membranous pieces, covered with scales like the rest of the body. The line is continued over the central pointed lobe of the caudal, and this portion contains 6 to 8 additional membranous pieces. All the scales are diaphanous and flexible, and cannot but with difficulty be distinguished in the fresh fish. The vertical diameter at occiput is  $\frac{1}{2}$ , at the anterior dorsal  $\frac{1}{3}$ , at the root of the caudal  $\frac{1}{12}$  of the total length. The anterior dorsal is placed in the middle of the back, at equal distance from the muzzle and the root of the caudal. The third ray, the longest, is  $4\frac{1}{2}$  in the total length; the rest gradually decrease; the last is a little more than  $\frac{1}{3}$  of the third ray, of which the extent of the base slightly exceeds  $\frac{1}{4}$ . The first ventral ray is placed opposite the first dorsal ray, at equal distance from the muzzle and the last anal ray. The fin extends to the middle of the anal, its length being  $\frac{1}{2}$  of the total. Outside the root appears a very thin elongated scale. The first anal ray is placed at equal distance from the last dorsal and the root of the caudal; the third ray, the longest, is  $7\frac{1}{2}$  in the total length, and twice the length of the last ray; the extent of the base equals that of the anterior dorsal. The adipose dorsal is rather large, elongated and placed opposite the posterior third of the anal fin. The caudal is divided in three pointed lobes, of which the upper and lower are about  $\frac{1}{2}$  of the total length; the central lobe, composed of the three elongated central rays, is either equal to, or a little shorter than the former two; almost the whole of the fin is covered with minute scales. The pectorals are falciform and extend in the young to the last dorsal ray, but they become shorter with age, and then vary from a little less than  $\frac{1}{2}$  of to  $3\frac{1}{2}$  in the total length. They appear to have no axillary scale.

The peritoneum is silvery; the stomach elongated, pyriform, thin and capable of enormous expansion; the fundus is arched, and separated from the rest by a constriction. The intestinal canal is narrow cylindrical, scarcely  $\frac{1}{2}$  of the total length. At the pylorus appears a series of 22 gradually decreasing caecal appendages. The liver and spleen are very small. The fish is of most voracious habits, gorging itself with its own species and other fishes of nearly its own size, and *Crustacea* (shrimps). It is frequently taken with the stomach and the jaws expanded with prey. It is very short-lived, more so than either of the two preceding species, and the whole body becomes at certain seasons brilliantly phosphorescent. In the Straits of Malacca it is at all times very numerous, although less so than it is at the Sandheads or in the mouths of the Ganges. Although very rich, it is a great delicacy immediately after it is taken. Salted and dried it is also highly valued, and in this state it occurs in commerce under the denomination of "*Bombay Ducks*," ("*Bummaloh*" in Bengal), large quantities of which are annually exported from Bombay and the Malabar coast to all parts of India.

#### FAM. CLUPEOIDÆ.

GEN. *CHIROCENTRUS*, (Cuvier, 1817) Valenciennes, 1846.

Body compressed, elongated, with small deciduous scales; abdomen trenchant, but not toothed; dorsal placed far back towards the tail, opposite the anal; pectorals pointed; in the axilla a bony, triangular, elongated appendage; ventrals excessively small; intermaxillary and upper maxillary with a single series of pointed horizontal teeth, of which one on each side of the symphysis longer than the rest; an oblique series of 5 or 6 card-like teeth on the palatals; a small oval group of velvety teeth on the anterior pterygoid, and some on the ala major; on each branch of the lower jaw a single series of long, but unequal teeth, compressed, trenchant, lance-shaped; a single series of minute conical teeth along the margin of the tongue, on the hyoid bone and the margin of the branchial arches. Branchiostegous rays eight.



## CHIROCENTRUS DORAB, (Forsk.)

*Clupea dorab*, Forskål, 72, No. 108.

*Clupea dorab*, Linné : Syst. 1409.

*Clupea dorab*, Lacépède.

*Esoce chirocentre*, Lacépède, V. Pl. 8, Fig. 1.

*Clupea dentex*, Bloch-Schneider, 428.

*Clupea dorab* ? Russell, CXCIX. Wallah.

*Clupea dorab*, Shaw, V. 175.

*Chirocentrus dorab*, Cuv. R. A. II. 326 (').

*Chirocentrus dorab*, Rüppell : Neue Wirb. Fische, 81.

*Chirocentrus nudus*, Swainson, II. 295.

*Chirocentrus dorab*, Richardson, Report, 1845, 311.

*Chirocentrus dorab*, Cuv. and Val. XIX. 150, Pl. 565.

*Chirocentrus dorab*, Bleeker : Verh. Batav. Gen. XXII. 6.

Párang-Párang of the Malays.

Head above and back intense blue with sea green reflections ; rest of the head and body shining silvery ; fins hyaline, caudal and pectorals dotted with black ; in some the caudal margins and the upper ray of the pectorals black ; tongue black. Iris silvery ; orbital margin bluish black.

D 16 or 17, C 19½, A 33 or 34, V 6 or 7, P 14 or 15, Br. VIII.

HABIT.—*Sea of Malayan Peninsula and Islands.*

Zanzibar, Isle of France, Red Sea, Muscat, Malabar, China

Sea, Isle of Buru, New Guinea, Celebes, Madura, Java,

Sumatra, Coromandel, Bay of Bengal, Gangetic estuaries.

TOTAL LENGTH : 6 feet.

The length of the head is  $6\frac{1}{2}$  in the total ; the depth at occiput  $\frac{2}{3}$  of the length. The horizontal diameter of the eye is  $\frac{1}{4}$  of the length of the head ; the distance across the forehead  $\frac{1}{4}$  of the diameter. The vertical diameter at the ventrals slightly exceeds the length of the head. The lower caudal lobe is frequently a little longer than the upper, and exceeds by  $\frac{1}{4}$  the length of the head. The fish is numerous at all seasons on the Malayan coasts. Individuals six feet in length are at Pinang of rare occurrence. Although not eaten by Europeans, this fish is highly valued by the natives of the different countries where it is found. The Malays denominate it from the resemblance of the large teeth to their favourite chopping knife (*párang*) and they apos-

trophize it in a popular epigrammatic stanza ("pantun,") quoted by Colonel James Low. (Dissertation on Pinang, &c. p. 181.)

GEN. CHANOS, (*Lacép.* 1803) *Valenciennes*, 1846.

(*LUTODEIRA*, [*v. Hasselt*,] *Rüppell*, 1828.)

Mouth toothless ; dorsal single ; pectorals and ventrals enclosed by elongated scaly appendages ; on each side of the deeply cleft caudal two scaly semilunar laminæ, each horizontally fixed to the upper and lowermost of the short, horizontal central rays ; abdomen rounded ; inside of œsophagus, lined by a spiral ridge the sides of which with numerous rounded papillæ, the margin with distant elongated papillæ ; outside of œsophagus marked by a corresponding spiral linear impression ; numerous appendicula cœcopylorica ; intestinal canal very long.

CHANOS PALA, (Cuvier.)

Russell, CCVII. Palah Bontah.\*

Cyprinus (*Leuciscus*) pala, Cuv. R. A. II. 276 (?).

Chanos nuchalis, Cuv. and Val. XIX. 197.

(*Adult.*) Head above and back glossy intense blue ; sides above the lateral line lighter, silvery with green reflections, becoming paler immediately beneath the line ; rest of the sides and abdomen silvery white ; lips pale brownish ; cavity of the mouth and tongue bluish white sparingly dotted with black ; sides of the head shining silvery with lilac and rose-coloured reflections ; dorsal and caudal rays greyish white, and as well as their pale brownish membrane minutely dotted with brown ; both fins broadly edged with blackish ; the caudal semilunar laminæ pale horn-colour ; pectorals and ventrals white, with the anterior half of their external surface powdered with blackish brown, their elongated scaly appendages shining silvery ; anal white, anterior half sparingly dotted with black. Iris silvery, orbital half pale brownish.

(*Young.*) Differs by the hyaline fins, of which the dorsal and caudal are but sparingly dotted with brown.

\* In Mr. Jerdon's memoir "*On the Fresh Water Fishes of Southern India*," in the *Madras Journal*, Vol. XV p. 344, the author refers a species of *Albula* ("*Butirinus maderaspatisensis*, Jerdon") to Russell, No. CCVII. As the latter belongs to a genus very distinct from *Albula* (*Butyrinus*, vide infra), Russell's species cannot be identical with "*Butyrinus maderaspatisensis*."

D 15, C  $19\frac{1}{2}$ , A 11, V 11, P 16, Br. IV.

HABIT.—*Sea of Pinang, Malayan Peninsula.*

Vizagapatam, Madras.

TOTAL LENGTH : 2 feet.

The length of the head is  $5\frac{1}{2}$  in the total ; but in the very young  $4\frac{1}{2}$ . The depth at occiput is  $\frac{2}{3}$  of the length of the head. The eye, bordering upon the profile, is situated a little in front of the second third of the head. The horizontal diameter is  $3\frac{1}{2}$  in the length of the head. The distance across the forehead slightly exceeds the diameter. The thick adipose fold has a circular pupillary opening. In the young the eye is comparatively larger, the horizontal diameter slightly exceeding  $\frac{1}{2}$  of the head. The symphysis of the lower jaw carries a small rounded tubercle fitting into a corresponding notch of the upper, behind which is suspended a narrow crescent-shaped membrane. The small tongue is elongated and immoveable. The greatest vertical diameter, in front of the dorsal, is a little less than the length of the head. The deepest portion of the body is covered by 26 longitudinal series of scales ; the first six to eight scales of each series, above as well as beneath the lateral line, are indeed somewhat larger than all the rest, but the size gradually decreases, and not abruptly, as represented in the figure of Russell. The latter is also incorrect in confining the larger and striated scales to the space *above* the lateral line, and the number of the longitudinal series is incorrect. The lateral line, composed of simple central tubes, declines towards the termination of the pectoral, from whence it continues straight on the thirteenth longitudinal series of scales to the middle of the caudal. It occupies 77 scales. The dorsal fin commences exactly in the middle between the muzzle and the root of the longest ray of the upper caudal lobe. The first three rays are undivided and gradually increase in length ; the fourth, the longest, is  $\frac{2}{3}$  of the length of the head. The upper margin of the fin is crescent-shaped, the last ray being elongated and nearly double the length of the penultimate. The base is enclosed between two series of elongated, obliquely set scales, of which there are thirteen on each side, gradually increasing in length so as to cover the lower half of the posterior rays. The caudal is deeply cleft, the lobes are  $3\frac{1}{2}$  in the total length ; in one individual the upper slightly exceeded the lower. The vertical diameter of the tail at the root of the caudal, is about  $\frac{1}{2}$  of the length of the

head. The semilunar laminae are closely pressed to the fin, with the free convex margin towards the lateral line; the length of the straight margin or base is  $\frac{1}{4}$  of the horizontal diameter of the eye. In the adult the vertical diameter of the laminae is  $\frac{1}{2}$  of the diameter of the eye, but in the young it is less. The extent of the base of the anal fin equals its distance from the root of the caudal; the anterior ray is very small and, as well as the second and third, undivided; the last ray is the longest, terminating in a narrow point, its length  $\frac{1}{2}$  of the head. The base like that of the dorsal is enclosed between two series of elongated scales of which the last half covers the corresponding ray. The ventrals commence opposite the posterior half of the dorsal, or halfway between the first pectoral and the last anal ray. The first ventral ray slightly exceeds  $\frac{1}{2}$  the length of the head; the outer scaly appendage is nearly  $\frac{2}{3}$  of the first ray; the inner one is much shorter and broader, triangular. The pectorals commence close to the abdomen, immediately behind the gill-opening; the first ray is about  $\frac{2}{3}$  of the length of the head. The outer scaly appendage is very long,  $\frac{2}{3}$  of the first ray; the inner one is broader and but half the length of the former. At Pinang single individuals occur at all seasons, and are highly valued for their very delicate flavour. The oesophagus is spindle-shaped, fleshy, exceeding half the length of the head by  $\frac{1}{2}$ . The external surface is smooth, with a spiral, linear impression, corresponding to the internal spiral ridge, which makes 21 very oblique turns. The ridge is of a triangular form, both sides are divided by numerous backwards-directed linear ridges, each of which carries a great number of small, soft, pointed papillae; the free margin towards the cavity of the oesophagus is smooth, but on that of the fourteen anterior turns appear some distant-pointed, backwards-directed papillae, which are much longer than those of the sides. The stomach consists of two portions, of which the anterior is cylindrical, narrow at cardia, bent like a double horse-shoe, and then joins the short, pyriform posterior portion. The latter is very fleshy, hard, gizzard-like. Both portions are lined by 6 to 10 longitudinal rather large folds; towards pylorus the coats are very thick, forming there two rounded hard protuberances. The length of the stomach slightly exceeds  $3\frac{1}{2}$  in the total. In one examined it contained some remains of vegetable matter, and green mucus. The duo-

denum is surrounded by numerous appendicula cœcopylorica, each of which divides in two or more portions, of which an innumerable mass, extending about  $1\frac{1}{4}$  inches from pylorus, envelops the intestine. Those nearest the pylorus are the longest, about one inch in length. The intestines, throughout of nearly uniform diameter, form many circumvolutions; from pylorus their length is about  $3\frac{1}{2}$  times that of the fish; but including œsophagus and the stomach, the length of the entire intestinal canal is a little less than four times the total length of the fish. The liver and the spleen are very large, the former elongated single-lobed; the latter of a beautiful black with purple reflections. The air-vessel is very large, spindle-shaped, terminating behind in an elongated point; the anterior margin is straight with a short pointed process on each side. It communicates with the anterior portion of the stomach through a short canal proceeding from the anterior part of the lower surface. Its coats are very thin, white, covered by the black peritoneum. In a male, 2 feet in total length, the intestinal canal was of the following dimensions.

|                                    |        |                             |
|------------------------------------|--------|-----------------------------|
| Œsophagus, .....                   | 0 feet | $2\frac{1}{4}$ inch.        |
| Anterior portion of stomach, ..... | 0 „    | 5 „                         |
| Posterior do. ....                 | 0 „    | $1\frac{1}{4}$ „            |
| Intestines, .....                  | 7 „    | $0\frac{1}{4}$ „            |
|                                    |        | <hr/>                       |
|                                    |        | 7 feet $9\frac{1}{4}$ inch. |

The description and figure of Russell, No. CCVII. *Palah Bontah*, establish beyond doubt the identity of the present species, which Dr. Rüppell believes to be identical with *Mugil chanos*, Forskål. The figure of *Lutodeira chanos*, Rüppell\* gives indeed the exact proportions of the fish observed at Pinang, and the anatomical details, the singular structure of the œsophagus and stomach of which Dr. Rüppell gave the first account, also correspond. But the length of the intestinal canal has been omitted, and till that is known, the identity cannot be decided. M. Valenciennes considers Russell's *Palah Bontah* to be distinct from *Mugil chanos*, Forskål in consequence of the eight or nine

\* Atlas, 18, Tab. 5, Fig. 1. SYN. *Mugil chanos*, Forsk. 74, No. 110.—*Mugil salmoneus*, J. R. Forster, Msc. IV. 14.—*Chanos arabicus*, Lacép. V. 395,—*Palah Bontah*, Russell, CCVII.—*Lutodeira indica*, Van Hasselt, apud Ferrusac.

oblique series of larger scales immediately behind the head. But, as observed above, Russell's figure is not correct; besides, it appears from references to Russell's figure of *Lutodeira chanos*, to M. Valenciennes' of *Chanos lubina*, (XIX. Pl. 567,) and lastly from inspection of a young individual of *Chanos tolo*, (Cuvier,) that also these species present behind the head a few series of scales a little larger than the rest. Leaving this character aside, the present species offers an anatomical difference from *Mugil chanos*, Forskål,\* of which according to M. Valenciennes the intestinal canal, from pylorus, measures eight times the length of the body. As observed above, in the present species the canal is about  $3\frac{1}{2}$  times, and with œsophagus and the stomach, a little less than four times the total length.

*CHANOS TOLO*, (Cuvier.)

Russell, CCVIII. Tooleloo.

Cyprinus tolo, Cuvier, R. A. II. 276 (').

Chanos chloropterus, Cuv. and Val. XIX. 195.

*Young.* Head above and back intense blue, lighter, silvery with green reflections above the lateral line; the rest and abdomen silvery white; sides of the head shining silvery with lilac reflections; fins yellowish white, dorsal and caudal minutely dotted with black, giving the margins a blackish appearance. Iris silvery, orbital margin blackish.

D 17, C  $19\frac{3}{8}$ , A 10, V 11, P 15, Br. IV.

*HABIT.*—*Sea of Pinang.*

River of Madepollam (Godavery).

*TOTAL LENGTH*:  $4\frac{1}{2}$  inch.

This species greatly resembles *C. pala*. It differs, however, in the following characters. The dorsal fin is placed a little farther forwards, the first ray, undivided as well as the succeeding four, rises in the centre between the muzzle and the commencement of the upper caudal lobe. The ventrals also are situated a little more forwards; the first ray commences at equal distance from the first pectoral and the eighth anal ray. The extent of the base of the anal is shorter than the space between the last anal ray and the root of the lower caudal lobe. In front of the dorsal fin the body is covered by 24 longitudinal series of

\* *Chanos arabicus*, Cuv. and Val. XIX. 187.

scales, of which the lateral line occupies the eleventh from above. The scales of the oblique series behind the head are a little larger than the rest, which although they appear smaller than in *C. pala*, are not so proportionally, nor does Russell's figure represent them so. The four caudal semilunar laminae resemble those of the former species. A single young individual was taken in a fishing-stake off the coast of Pinang in March 1845. The fishermen asserted that it is an inhabitant of rivers, and but rarely enters the sea.

GEN. ALBULA, (Gronov. 1763) Valenciennes, 1846.

(BUTYRINUS, [Commerson] Lacép. 1803.)

Body fusiform, covered with numerous hard, firm scales, disposed in longitudinal series; one such before and behind the dorsal fin, (on the keel of the back) of a little larger scales\*; head large, naked, above with the grooves between the keels of the bones appearing through the skin; eye with a thick adipose lid; muzzle conical, pointed, projecting far beyond the lower jaw; dorsal small, ventrals commencing opposite the posterior part of the latter; card-like teeth in the upper intermaxillaries and the lower jaw, on the vomer palatals and pharyngeals; small globular teeth on the spheroid, pterygoid, and hyoid bones.

ALBULA ERYTHROCHEILOS, Cuv. and Val.?

*Albula erythrocheilos*, Cuv. and Val. XIX. 352, Pl. 540?

Head above and back blackish silvery; sides and abdomen frosted silvery, the edges of the scales shining; infraorbitals and opercles brilliant silvery; on each side of the yellowish white muzzle a short backwards and downwards directed black line, not, however, joining its neighbour on the lower surface; in the small groove containing the apertures of the nostrils a minute crescent-shaped black spot bordering the anterior half of the apertures; a gamboge line from the posterior part of the second infraorbital borders above the single series of scales and extends to the anterior margin of the preopercle; margin and cavity of the mouth white; dorsal rays yellow, their upper fourth blackish; membrane pale brownish dotted with black; caudal yellow, posterior

\* In the species here described they are not larger than the rest.

margin blackish; anal silvery hyaline; ventrals hyaline, rays of the anterior half and the pectorals bright gamboge. Iris silvery, orbital margin pale golden.

D 18 or 19, C  $19\frac{1}{2}$ , A 8 or 9, V 11, P 17 or 18.

Br. left XIV, right XIII.

or „ XVI, „ XV.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH:  $9\frac{1}{4}$  inch.

The length of the head is  $4\frac{1}{2}$  in the total; the depth at occiput slightly exceeds half the length. The parietal protuberances and the posterior keels of the frontal bones are sufficiently developed to make the space between them appear hollowed; the sutures of the frontals and parietals form an acute angle in front of the eye; the frontals are slightly convex; the internal cavernous keels are sharp, so as to deepen the narrow central groove. The nostrils open a little behind the second half between the muzzle and the eye; they are situated in a small oval longitudinal groove, the upper and lower margins of which are raised, so as to form sharp keels, the upper one of which rises on the profile like a short arch. The eye occupies the middle of the side of the head, bordering on the profile, which is slightly arched by the lateral part of the frontal bone which forms the roof of the orbit. In front of the anterior part of the orbital margin of the frontal appears a narrow bone, analogous to the supraorbital of *Cyprinoidæ*. The horizontal diameter of the eye is  $4\frac{1}{2}$  in the length of the head, of which the distance across the forehead is but  $\frac{1}{4}$ . The thick adipose fold covering the eye has a vertically elliptical aperture corresponding to the pupil which, however, is circular. In form the seven infraorbital bones and the opercles resemble those of *Albula macrocephala*, (Lacép.) Between the cheek and the horizontal part of the preopercle appears a single series of 7 to 9 scales, but little smaller than those of the body. The tongue and teeth resemble those of the latter species. In the adult there are no teeth on the upper maxillary bone, but in an individual  $8\frac{1}{4}$  inch in length, four small pointed distant teeth appeared along the margin of the left branch, and on the right two immediately behind the intermaxillary, and one tooth close to the angle of the mouth. A small accessorian maxillary appears at the posterior margin of each branch. The thin narrow interopercle is arched, with the convex



margin downwards, occupying the sides of the throat. In four individuals examined the left branchiostegous membrane overlapped the right and presented one additional ray. Two measuring  $9\frac{1}{4}$  inch, and one  $8\frac{1}{4}$  inch in length, had 16 branchiostegous rays in the left, 15 in the right membrane. A fourth,  $9\frac{1}{4}$  inch in length, had 14 in the left, 13 in the right membrane. The two or three anterior rays are short, linear, and not sabre-like as the rest, and as they are hid by the lax membrane, they may easily escape observation, unless they are brought to view by dissection. The greatest vertical diameter of the body, in front of the dorsal, is  $\frac{1}{4}$  of the total length. The scales are disposed on 15 longitudinal series, and in general form resemble those of *A. macrocephala*, (Cuv. and Val. XIX. Pl. 573.) Examined through a compound microscope, (385 linear), the longitudinal striæ appear to be composed of horse-shoe-like protuberances, not of bead-like strings, as in *macrocephala*. The lateral line occupies the ninth series; it follows for a short distance the gill-opening, and then continues straight in the middle of the side to the root of the caudal. It is composed of simple central tubes, on 72 to 78 triangular scales, somewhat smaller than the rest. All the fin-membranes are covered by minute oblong scales, either transparent or silvery. The dorsal fin commences a little in front of the centre between the muzzle and the root of the caudal. The central series of scales of the back are not larger than the rest, but on the contrary, somewhat smaller. The ventrals commence not behind the posterior dorsal ray, but opposite the 13th or 14th. In form all the fins resemble those of *A. macrocephala*, but the upper caudal lobe, equal the length of the head, is longer than the lower. In three individuals the difference scarcely exceeded  $\frac{1}{8}$ , but in a fourth the lower lobe was but  $\frac{2}{3}$  of the upper one. The stomach is elongated cylindrical, capacious, very thin. It contained remains of small shrimps. Round the pylorus appear fourteen large appendicula cœcopylorica. The intestinal canal is simple, little more than half the total length of the fish. The other viscera resemble those of *A. macrocephala*. Four individuals were taken in February 1845 in fishing-stakes off the coast of Pinang. The fishermen, evidently not well acquainted with the species, asserted it to be of rare occurrence, and highly valued. Out of water it soon expires and becomes soft. This fish nearest agrees with *A. erythrocheilos*. It differs in the

number of branchiostegous rays, but as M. Valenciennes drew up his description from a single specimen, and as the character is liable to individual variations, it is without actual comparison of specimens not sufficient to distinguish species, which so nearly resemble each other as those of the genus *Albula*.

GEN. DUSSUMIERIA, Valenciennes, 1847.

Form of the body resembling Gen. *Sardinella*, but the abdomen smooth, not toothed; fine teeth in the jaws, on the tongue, palatal and pterygoid bones; those of the two latter resembling a fine rasp.

DUSSUMIERIA ACUTA, Cuv. and Val.

Dussumieria acuta, Cuv. and Val. XX. 467, Pl. 606.

Támбан bulat of the Malays.

Head above, back and upper third of the sides deep glossy blue, bordered by a longitudinal band of pale copper-red; the rest of the head and body shining silvery; dorsal hyaline, minutely dotted with black along the base; caudal whitish or yellowish minutely dotted with black, posterior margin blackish; rest of the fins hyaline; jaws minutely dotted with black: symphysis of the upper jaw black; on each side of that of the lower a short dotted black line; tongue bluish, dotted with black. Iris silvery, orbital margin blackish.

D 19 to 21, C  $19\frac{1}{2}$ , A 14 to 17, V 8, P 13 or 14, Br. XV.

HABIT.—Sea of Pinang, Malayan Peninsula, Singapore.

Malabar, Coromandel, Bencoolen.

TOTAL LENGTH: 6 inch.

The length of the head is contained  $4\frac{1}{2}$  times in the total; the depth at occiput  $2\frac{1}{2}$  in the length of the head. The eye, bordering on the profile, occupies the middle of the head; the horizontal diameter is  $\frac{1}{2}$  of the length of the head; the distance across the forehead  $\frac{1}{2}$  of the diameter; the thick adipose fold covering the eye has a small circular pupillary opening. The left branchiostegous membrane slightly overlaps the right, but the number of the rays of both is equal. The greatest vertical diameter in front of the dorsal is  $5\frac{1}{2}$  in the total length. The scales are small, rounded and very deciduous. The dorsal fin commences at equal distance from the muzzle and the centre of the posterior caudal margin. Single individuals of this species occur at Pinang at all seasons, but

numbers from June to September. It is highly valued for its delicate flavour, and passes commonly as a 'Sardine.' The latter denomination it shares, however, with *Clupeonia perforata*, (vide infra,) with which it is also confounded by the Malays under the common name of *Ikan tamban*. Both species have been prepared as 'Sardines à huile.'

GEN. ELOPS, (Linné, 1766.) Cuv. and Val. 1846.

(MEGALOPS, Lacépède, 1803).

Branchiostegous rays remarkably numerous; a single bony plate between the branches of the lower jaw under the branchiostegous membrane; gape very large; intermaxillaries short; maxillaries long, free; both, as well as the palatals, vomer, pterygoids, sphenoids, lower jaw, lingual and hyoid bones covered with fine velvety teeth; body elongated, and as well as the abdomen, rounded; above and below at the root of the caudal a more or less elongated, spine-like scale; pectorals and ventrals with an elongated scaly appendage; last dorsal ray in some terminating in an elongated filament.

ELOPS SAURUS, Linné.

The Pounder, Sloane: Hist. of Jamaica, 284, Pl. 251, Fig. 1.

*Argentina machnata*, Forskål, 68, No. 100.

*Elops saurus*, Linné: Syst. 1394.

*Argentina carolina*, ibid. 1395.

*Mugilomore anne-caroline*, Lacép. V. 398.

Russell, CLXXIX. Jinagow.

*Argentina machnata*, Shaw, V. 129.

*Argentina carolina*, ibid.

*Elops inermis*, Mitchill: Trans. Lit. and Phil. Soc. New York, I. 445.

*Elops machnata*, Cuv. R. A. II. 324 (').

*Elops machnata*, Rüppell: Neue Wirbelth. Fische, 80.

*Elops indicus*, Swainson, II. 292.

*Elops saurus*, De Kay: Zool. New York, III. 267, Pl. XLI. Fig. 131.

*Elops machnata*, Richardson: Report, 1845, 311.

*Elops machnata*, Richardson: Ichthyol. Erebus and Terror, Pl. XXXVI. Figs. 3, 4, 5.

*Elops saurus*, Cuv. and Val. XIX. 365.

*Elops saurus*, Bleeker: Verh. Batav. Gen. XXII. 6.

(Young). Head above silvery green; back dark-blue, light bluish green on the sides above the lateral line; the rest of the body and head shining silvery; dorsal membrane yellowish white, minutely dotted with brown, anterior margin black, and the anterior two thirds of the upper margin broadly brimmed with black; anterior half of pectorals and ventrals gamboge, anal and caudal hyaline; the latter with the upper and lower margin blackish. Iris silvery.

D 24, C 19½, A 17, V 15, P. 19; Br. *left* XXX, *right* XXIX.\*

HABIT.—*Sea of Pinang.*

Isle of France, Java, Celebes, Madura, Red Sea, Comor-  
mandel, China Sea, Japan, Senegal, New York, New  
Orleans, St. Domingo, Martinique, Mexico, Surinam,  
Brazil.

TOTAL LENGTH: 11 inch.

The length of the head is  $\frac{1}{4}$  of that of the body, the caudal not included, or with the latter  $4\frac{1}{4}$  times in the total. The length at occiput is  $\frac{1}{4}$  of the length of the head. The eye bordering on the profile, occupies the second fourth of the head, the horizontal diameter is a little less than  $\frac{1}{4}$  of the head; the distance across the forehead is a little less than  $\frac{2}{3}$  of the diameter. The adipose fold surrounding the orbit forms a large circular opening, corresponding to the pupil. The left branchiostegous membrane overlaps the anterior half of the right. The elongated bony plate between the branches of the lower jaw exceeds by  $\frac{2}{3}$  the horizontal diameter of the eye. The greatest vertical diameter, in front of the dorsal, is  $\frac{1}{4}$  of the total length. The lateral line is composed of a simple central tube on each scale. It follows nearly the middle of the side, proceeding straight to the centre of the posterior margin of the caudal. The stomach of a solitary young individual, observed at Pinang in February 1845, contained remains of small Crustacea and Fishes.

\* Russell, . . . D 22, C 28, A 14, V 14, P 17, Br. XXX.

Rüppell, . . . „ 23, „ 19½, „ 16, „ 15, „ 19, „ XXVIII or XXIX.

Cuv. and Val. „ 23, „ 31, „ 15, „ 15, „ 18, „ XXIX, or XXXV.

De Kay, . . . „ 24, „ 20½, „ 17, „ 14, „ 15.

Richardson, . . „ 24, „ 19½, „ 17, „ 14, „ 17, „ XXXII.

## ELOPS CUNDINGA, (Buchan. Ham.)

*Clupea cyprinoides*,\* Broussonnet : Decade.

*Clupea cyprinoides*, Joh. Forster : Spicil.

*Clupea apalike*, Lacépède, V. Tab. 13, Fig. 3.

Russell, CCIII. Kundinga.

*Cyprinodon cundinga*, Buchan. Ham. 254, 383.

*Megalops filamentosus*, Cuv. R. A. II. 324.

*Megalops filamentosus*, Swainson, II. 293.

*Megalops indicus*,† Cuv. and Val. XIX. 388, Pl. 577.

*Megalops filamentosus*, Jerdon : Madras Journ. XV. 344.

*Megalops indicus*, Bleeker : Verh. Batav. Gen. XXII. 6.

Head above dark olive ; back blackish blue silvery ; sides and abdomen frosted silvery with bluish reflections, the lateral line and the margins of the scales shining silvery, as well as the sides of the head ; above the upper margin a large blackish silvery spot ; centre-part of both jaws blackish ; dorsal and caudal greyish, minutely dotted with black, margins as well as the last elongated dorsal ray blackish ; rest of the fins hyaline, in some dotted with black, and the last anal ray blackish. Iris shining silvery, orbital margin blackish.

‡D 19 or 21, C 19½, A 26, 27 or 28, V 10 or 12, P 15 or 16,

Br. left XXVI, right XXV.

or „ XXV, „ XXIV.

HABIT.—*Sea and freshwater, Pinang, Malayan Peninsula.*

Freshwater and coasts of Otaheiti, Isles of Tanna and Buru, China Sea, Port Essington, Polynesia, Madagascar ; Rivers of Java, freshwater and Sea of Madura, Celebes, Malabar, Coromandel, Gangetic estuaries.

TOTAL LENGTH : 1 foot.

\* M. Valenciennes has fully exposed (XIX. 384) the confusion of the Indian and American species by Broussonnet, Bloch, Gmelin, Bonaterre, Lacépède and Shaw, whose specific names are therefore inadmissible.

† *Elops indicus*, preoccupied, being one of the synonymes of *Elops saurus*, Linné, (vide supra.)

‡ Russell,..... D 18, C 26, A 25, V 9, P 15, Br. XXIII.

Buchanan,.... „ 19, „ 19, „ 26, „ 10, „ 15, „ XXV.

Cuv. and Val., „ 18, „ 30, „ 25, „ 11, „ 14, „ XXIV—XXV.

The length of the head is  $4\frac{1}{2}$  in the total ; the depth at occiput  $\frac{1}{2}$  of the length. The horizontal diameter of the eye is  $2\frac{1}{2}$  in the length of the head, the distance across the forehead is  $\frac{1}{2}$  of the diameter. The greatest vertical diameter, in front of the dorsal, equals the length of the head. The scales are disposed on twelve longitudinal series, of which the sixth carries the lateral line. The latter declines towards the dorsal from whence it continues straight to the caudal. In the adult it occupies from 38 to 41 scales, each carrying a rather indistinct central tube, from above and below which radiate backwards from six to eight fine branches. The left branchiostegous membrane partially overlaps the right. The elongated bony plate between the branches of the lower jaw slightly exceeds the horizontal diameter of the eye. Of the anterior dorsal rays the fourth or the seventh is the longest, about  $\frac{1}{2}$  of the length of the head. The last dorsal ray is divided in two portions of which the posterior is again divided in two filaments, provided in front and behind with a narrow loose membrane. The filament in some reaches the root of the caudal, but it is frequently much shorter, particularly in old individuals. A young one,  $4\frac{1}{2}$  inch in length, differed in, contrary to the generality of fishes, having the eye proportionally smaller than the adult ; the lateral line, occupied but 29 scales, each carrying a very distinct central tube with two or three short spine-like branches ; the dorsal filament was very short, its length less than the longest of the anterior rays ; the left branchiostegous membrane contained but 23 rays, the right one less, and the colour of the head and back were paler than in the adult. At Pinang single individuals are taken at all seasons in the fishing-stakes off the coast ; but those inhabiting fresh-water are numerous. In both localities their food is small fishes and crustacea, but in the latter they also prey upon insects. Notwithstanding their numerous fine bones they are valued for their flavour, which loses nothing by their being introduced in tanks where they rapidly multiply and fatten. M. Valenciennes considers *Megalops setipinnis*, Richardson,\* to be identical with, and *M. curtifilis*, Richardson,† to be the young of the present species.

\* *Ann. Nat. Hist.* X. 493, and *Report*, 1845, 310.

† *Report*, 1845, 310.

GEN. PELLONA, Valenciennes, 1847.

(PLATYGASTER, \* Swainson, 1839.)

Teeth in the jaws, on the palate, pterygoid bones and on the tongue, but not in the vomer; body compressed; ventrals in front of the dorsal; anal elongated; abdomen strongly toothed; air-vessel communicating with œsophagus by a small tube inserted at the extremity of the stomach.

PELLONA AFFINIS, (Swainson.)

(Icon.) Clupea affinis, Gray: Illustr. Ind. Zool. I, Pl. 96.

Platygaster affinis, Swainson, II. 294.

Clupea (Ilisha) affinis, Richardson, Report: 1845, 206. Note.

Pellona grayana, Cuv. and Val. XX. 315.

Head above and back greyish green minutely dotted with black; lighter, silvery above the lateral line; rest of the sides, abdomen, cheeks and opercles silvery; dorsal, caudal and anal yellow; the external half of the two former minutely dotted with black; rest of the fins hyaline. Iris silvery, orbital margin blackish.

D 16, C 19½, A 50 to 52, V 7, P 15, Br. VI.

HABIT.—Sea of Pinang, Malayan Peninsula, Singapore.

China Sea, Bay of Bengal.

TOTAL LENGTH: 1 ft.

The length of the head is  $\frac{1}{2}$  of the total. The horizontal diameter of the eye is  $4\frac{1}{2}$  in the length of the head; the distance across the forehead slightly exceeds one diameter. The greatest vertical diameter, in front of the dorsal, is  $3\frac{1}{2}$  in the total length. The dorsal commences in the middle between the muzzle and the centre of the posterior caudal margin. The caudal lobes are equal:  $\frac{1}{2}$  of the length of the head. The anal commences opposite the posterior fourth of the dorsal. The small ventrals are situated opposite the second third of the distance between the muzzle and the root of the caudal. Smaller individuals of this species are numerous at Pinang at all seasons, and are consumed fresh or dried by the natives.

\* Preoccupied by *Platygaster*, Latreille, 1809 (*Hymenoptera*).

## GEN. RACONDA, Gray.\*

Dorsal fin none; rest like *Pristigaster*.

## RACONDA RUSSELLIANA, Gray.

*Raconda russelliana*, Gray: Zool. Miscell. 9.

(Icon.) *Apterygia ramcarate*, Gray: Ill. Ind. Zool. II. Pl. 92, Fig. 1.

*Pristogaster* (*Apterygia*) Swainson, I. 277.

*Apterygia hamiltonii*, Cuv. and Val. XX. 333.

Head above and back deep blue, upper third of the sides polished copper-coloured; rest of head and body shining silvery with mother-of-pearl reflections. Behind the upper part of the opercle a black spot; caudal pale yellowish minutely dotted with black, particularly towards the posterior margin; anal and pectoral rays yellowish or white, membranes hyaline. Iris silvery, orbital margin blackish blue.

D 0, C 19½, A 83 or 84, V 0, P 12, Br. VI.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Bay of Bengal, Mouths of Ganges.

TOTAL LENGTH: 8 inch.

The length of the head is 6½ in the total. The horizontal diameter of the eye is 3½ in the length of the head; the distance across the forehead is ⅔ of the diameter. The eye occupies the middle of the length of the head, and is situated close to the concave profile without bordering upon it. The infraorbital is narrow, elongated, much too short to cover the maxillary. The intermaxillaries are short, narrow, linear and fixed transversely across the muzzle. The upper maxillary bone is much longer and broader than in *Pristigaster tartore*; when the mouth is opened it projects beyond the throat, and when closed it

\* What has been published of this species appears to be confined to the figure in *Hardwicke's Illust. of Ind. Zool. of Apterygia ramcarate*, and a very short notice in *Zoological Miscellany*. But for the absence of the dorsal fin, the resemblance to *Pristigaster tartore*, Cuvier, (Russell, CXCIII. *Tartore*), is so striking, that it is not surprising, that M. Valenciennes should have considered the undescribed figure of *Apterygia ramcarate* ("*hamiltonii*," as quoted in *Hist. des Poiss.* XX. 333,) to represent a mutilated specimen of *Pristigaster tartore*. The following is Mr. Gray's description of *RACONDA RUSSELLIANA*: "*Silvery; Sander Roads. A species distinguished from the want of the fin by the fishermen: there are two specimens in British Museum, neither shewing the slightest indication of that organ.*" (Zool. Miscell. l. c.)



extends to opposite the posterior margin of the orbit; the length is  $\frac{1}{2}$  of that of the head, the breadth  $\frac{2}{3}$  of the diameter of the eye; the upper extremity is obliquely truncated, the lower forms a rather long, slightly backwards arched point. The lower jaw projects a little beyond the upper, which the branches equal in breadth, but they are shorter. The teeth of both jaws are very minute and placed in a single series; the rest are velvety or like a fine file. The mouth is small; the tongue free, flattened, oval. The opercle is triangular with the posterior extremity rounded or less pointed than in *P. tartoore*. The preopercle is narrower, and scarcely broader than the arched subopercle and interopercle, which two latter are proportionally broader in the present species. The branchiostegous membrane is small; its two anterior rays short and slender; the posterior four broad and flattened. The profile of the head is concave, rising to a little behind the occiput, from whence the back gently declines towards the root of the caudal. The abdominal arch continues increasing towards the root of the anal, from whence the profile gradually ascends. The greatest diameter of the body, at the root of the pectorals, slightly exceeds  $\frac{1}{2}$  of the total length; at the occiput it is  $\frac{1}{3}$ ; at the root of the caudal it is about  $\frac{1}{2}$  of the length of the head. The lateral line commences high up from the supra-scapular bone, and continues close to the profile of the anterior third of the back when it suddenly terminates. Another fine line follows the upper fourth of the side to the root of the caudal. The scales are of moderate size, oval, excessively thin and so deciduous, that the exact number cannot be ascertained. The trenchant abdominal profile contains upwards of 38 spines. The caudal is deeply cleft, the lower lobe, longer than the upper, equals the length of the head. The distance from the muzzle to the anal is  $2\frac{1}{2}$  in the total length. The extent of the base is  $\frac{1}{2}$  of the total length, (in *P. tartoore* it is little more than  $\frac{1}{2}$ ), the length of the rays does not exceed the horizontal diameter of the eye. The first pectoral ray, the longest, is situated nearly in the centre of the vertical diameter; it is broad, sword-like, with distinct articulations; its length is a little less than the head. At Pinang individuals from 4 to 6 inches in length are numerous at all seasons, although less so than they are at the Sandheads and the mouths of the Ganges. The Bengal fishermen denominate the species "*Potassah-Fessah* or -*Phasah*." "*Fessah*" or "*Phasah*," as Buchanan Hamilton observes, is in Bengal a

generic term, particularly applied to *Engraulis phasak* (Buchan.) and *E. telarah*, (Buch.) It is a heavy swimmer, and like the rest of *Clupeoidæ*, expires immediately on leaving its element. It is chiefly consumed in a dried state.

GEN. CLUPEONIA, Valenciennes, 1847.

Teeth on the tongue and pterygoid bones; palatals, vomer and jaws\* toothless.

CLUPEONIA PERFORATA, Cantor.

Támбан népis, or Támбан báful of the Malays.

Head above yellowish green; back and upper third of the sides bluish green with silvery reflections; muzzle and chin blackish; rest of the head and sides and abdomen shining silvery with rose-coloured and ultramarine reflections; dorsal bright yellow, upper half minutely dotted with black; a black spot over the root of the anterior four rays; caudal pale bluish green, posterior half minutely dotted with black; rest of the fins white. Iris silvery, orbital margin black.

D 17 to 20, C 17½, A 19 or 20, V 8, P 15, Br. V.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

*Sumatra.*

TOTAL LENGTH: 5½ inch.

The general form is elongated, compressed; the abdomen is slightly more arched than the back. The length of the head is  $\frac{1}{2}$  of the total; the eye is placed a little nearer the muzzle than the gill-opening; the horizontal diameter is a little less than  $\frac{1}{2}$  of the head, but equals the distance across the forehead. The muzzle is bluntly pointed, the lower jaw very little longer than the upper. The small tongue is elongated oval; in the middle a little behind the apex appears a single series of very minute pointed teeth; on the palatals they are numerous but distant; the four to six on each side of the symphysis of the lower jaw are less minute; all are deciduous. The vertical diameter at occiput is  $\frac{2}{3}$  of the length of the head; the greatest vertical diameter of the body, in front of the dorsal, is  $\frac{1}{2}$  of the total length. The dorsal is placed at equal distance from the muzzle and the root of the caudal; the extent of the base is  $2\frac{1}{2}$  in the length of the head; the upper mar-

\* In the species here described a single series of 4 to 6 minute deciduous teeth appears on each side of the symphysis of the lower jaw.

gin is falcated ; the fourth and fifth, the longest rays, equal the extent of the base ; the last ray is elongated,  $\frac{1}{2}$  of the fifth ray. The caudal is deeply cleft ; the length of the lobes slightly exceeds  $\frac{1}{2}$  of the total length. The distance from the caudal to the anal equals the horizontal diameter of the eye ; the extent of the base of the anal is  $\frac{2}{3}$  of the head ; the rays are  $\frac{2}{3}$  of the diameter of the eye, but the last is a little elongated. The ventrals are placed opposite the middle of the dorsal, at equal distances from the root of the upper pectoral and the first anal ray ; their length is  $2\frac{1}{2}$  in the head. The length of the pectorals is  $\frac{2}{3}$  of the head. The scales are very deciduous, thin, and large, their circumference nearly equalling the eye. They have excessively fine vertical lines, and besides three larger distant ones, traversing the whole height of the scales ; parallel to the posterior margin appears an irregular series of minute oval holes. There are eleven series on each side, and about 45 scales between the gill-opening and the caudal. Single individuals occur at Pinang at all seasons, but great numbers during June, July and August. They are of delicate flavour and pass in the settlements of the Straits under the denomination of 'Sardines,' in imitation of which they are sometimes preserved in oil. A resemblance to *Alausa argyrochloris*, Cuv. et Val. (vol. XX. p. 440) is farther increased by the impossibility of perceiving the teeth either in fresh state or in specimens preserved in spirits of wine. They require the aid of a lens to be distinguished in the skeleton. The general form, the yellow dorsal fin with a small black spot give the present species a certain resemblance to *Meletta venenosa*, Cuv. et Val. (vol. XX. p. 377). Some specimens of *Clupeonia perforata*, procured by W. T. Lewis, Esq. Assist. Resid. Councillor, Pinang, were accompanied by the following account of a phænomenon witnessed by that gentleman during his official residence at Bencoolen. In 1822 great numbers of what was supposed to be this identical species, presented the unusual appearance of having red eyes. Many natives after having eaten these fishes, were suddenly attacked with violent vomiting, which in cases where remedies were not immediately applied, was known within an hour to terminate fatally. At the same time such of these fishes with the ordinary silvery eyes, were as formerly eaten with impunity. This phænomenon reoccurred at Bencoolen during the seasons of 1823 and 1825, but not of 1824. It was surmised that the poisonous fishes

had fed on a gelatinous substance which at that season exudes from the beautifully coloured coral reefs on that part of the coast of Sumatra. It is, however, more probable that the poisonous fishes were shoals of *Meletta venenosa*, an inhabitant of the Seychelles and the neighbouring seas, which happened in those seasons to visit Sumatra. M. Valenciennes describes this fish as being poisonous, and producing effects as noted above. In the Straits of Malacca *Clupeonia perforata* has never been known to produce bad effects.

GEN. KOWALA, Valenciennes, 1847.

Minute teeth in the jaws and on the pterygoid bones; tongue, vomer and palatals\* toothless.

KOWALA THORACATA, Cuv. and Val.

Russell, CLXXXVI. Kowal.

*Clupea kowal*, Rüppell: Neue Wirbelth. Fische, 79.?

*Kowala thoracata*, Cuv. and Val. XX. 363.

Head above and back deep blue with green reflections; upper third of the sides silvery sea-green; rest of the body, cheeks and opercles shining silvery with mother-of-pearl reflections; upper part of the opercle pale bluish dotted with black; dorsal and caudal pale yellow greenish, sparingly dotted with black, particularly towards the margin; in some individuals a vertical elongated blackish spot at the root of the five central rays; rest of the fins white. Tongue and inside of the mouth minutely dotted with black. Iris silvery, orbital margin black.

D 19, C 19½, A 21 or 22, V 8, P 15, Br. VI.

HABIT.—*Sea of Pinang.*

Coromandel, Red Sea.

TOTAL LENGTH: 5½ inch.

The length of the head is  $\frac{1}{4}$  of the body,  $\frac{1}{4}$  of the total length. The horizontal diameter of the eye slightly exceeds  $\frac{1}{3}$  of the length of the head; the distance across the forehead is  $\frac{2}{3}$  of the diameter. The eye is covered by a thick adipose duplicature with a vertically elliptic aperture over the circular pupil; it occupies the middle of the distance between the muzzle and the posterior margin of the opercle, and bor-

\* Minute teeth, deciduous like the rest, appear on the palatals of the two species described.

ders on the profile. The figure of Russell represents the eye much too small, probably owing to the adipose fold having been overlooked. On the surface of each of the posterior frontal bones appear upwards of 11 backwards radiating lines. In the individuals examined at Pinang there appeared from six to eight teeth in the lower jaw, and some on the palatal and pterygoid bones, but none in the upper maxillaries, intermaxillaries, nor on the vomer. These teeth are so minute that they require to be seen through a lens in dried specimens, and they are so very deciduous that their number and position vary not only individually, but from side to side. The scales of the body are large, rounded, very thin and deciduous; those of the back and upper third of the sides have each upwards of 16 longitudinal striae. The sides are covered by 11 longitudinal series of scales, of which there appear to be upwards of 45 in the longest series. There are 35 spines on the abdominal profile, the scales of which resemble in breadth those of the species of *Pellona*. The greatest vertical diameter of the body, in front of the dorsal, is a little less than  $\frac{1}{2}$  of the total length. The dorsal occupies the middle of the distance between the muzzle and the root of the caudal; the fourth ray, the longest, equals the extent of the base, which is  $\frac{1}{2}$  of the greatest vertical diameter of the body. The fin is half covered by an oblique backwards rising series of scales which almost hide the last rays. The caudal is deeply cleft, the lobes exceed by  $\frac{1}{2}$  the length of the head. The scaly anal rays are very short; the last slightly elongated; the extent of the base is  $\frac{2}{3}$  of the length of the head; its distance from the root of the caudal is  $\frac{1}{2}$  of the extent. The ventrals are situated opposite the centre of the dorsal, exactly in the middle between the root of the first pectoral and anal rays; their length is  $\frac{1}{2}$  of the head. The length of the pectorals is  $\frac{2}{3}$  of the head. At Pinang single individuals are of rare occurrence.

KOWALA LAUTA, Cantor.

*Clupea kowal*,\* Temm. et Schlegel: Fauna Japon. Pisc. 235, Tab. CVII. Fig. 1.

Anterior half of the head above greenish grey dotted with black; posterior half and back intense glossy blue; upper half of the sides light golden green; rest of the body shining silvery with mother-of-

\* *Clupea kowal*, Rüppell, vide *Kowala thoracata*, Cuv. and Val.

pearl reflections; behind the upper part of the opercle a rounded yellowish brown spot dotted with black, from which proceeds along the upper fourth of the side a yellowish brown band, terminating at the upper fourth of the root of the caudal; cheeks and opercles shining silvery with golden and sky-blue reflections; the temples minutely dotted with black; dorsal bright gamboge, anterior and upper margin blackish; caudal pale greenish yellow, upper and posterior margin blackish; rest of the fins white. Tongue and cavity of the mouth minutely dotted with black. Iris silvery, orbital margin blackish.

D 19, C 19½, A 16 or 18, V 8, P 15, Br. VI.

HABIT.—*Sea of Pinang.*

Japan.

TOTAL LENGTH: 6 inch.

In addition to the colours and the number of anal rays this species presents the following characters distinguishing it from *K. thoracata*. In the intermaxillaries and upper maxillaries appear single, widely spread, pointed teeth; in the lower jaw from 8 to 12 such very little larger; those on the palatal and pterygoid bones are more numerous, but also with irregular intervals, indicating that the teeth are deciduous. All are so minute that they cannot be seen in fresh specimens, and in dried ones but through a lens. The fifth dorsal ray, the longest, is less than  $\frac{1}{2}$  of the greatest vertical diameter of the body, and equals the extent of the base of the fin; the last ray is a little elongated. The last anal ray is also a little elongated, and extends halfway to the root of the caudal. The ventrals are placed more forwards than in *K. thoracata*; the first ray commences opposite the second third of the dorsal, and its distance from the first anal ray exceeds by  $\frac{1}{2}$  that from the root of the first pectoral ray. The sides are covered by 11 longitudinal series of scales, the longest series containing about 35 scales. The rest of the characters noted under *K. thoracata*, are precisely the same in the present species. Two individuals exactly similar, except in the number of anal rays, occurred together at Pinang in June 1844.

GEN. ALAUSA (ALOSA, Cuvier 1817) Valenciennes 1847.

Small deciduous teeth in the jaws; all other parts of the mouth toothless.

**ALAUZA TOLI, Cuv. and Val.**

*Alauza toli*, Cuv. and Val. XX. 435.

Ikan trúboh or trúbu of the Malays.

*Adult.* Head above, back and upper third of the sides light greenish grey or lead-coloured; the scales strongly iridescent silvery; their margins dotted with black; rest of the sides, abdomen, cheeks and opercles strongly iridescent silvery; dorsal pale lead-coloured, in some individuals sparingly dotted with black; caudal scaly, pale silvery; upper lower and posterior margin minutely dotted with black; rest of the fins white. Iris mother-of-pearl, orbital margin blackish.

Or: head and body, instead of silvery, shining reddish yellow brass coloured; fins pale reddish yellow. Iris brass coloured.

*Young.* Like the adult, but with a more or less distant blackish spot behind the upper part of the gill-opening and an indistinct vertical blackish spot at the root of the five central rays of the caudal; upper half of dorsal closely dotted, so as to appear blackish.

D 18, C 19½, A 19, V 8, P 15 or 16, Br. VI.

*HABIT.*—*Sea of Pinang, Malayan Peninsula, Singapore.*

Borneo, Java, Sumatra, Pondicherry, River Cavery,  
Bombay.

**TOTAL LENGTH:** 1 ft. 6 inch.

The length of the head is contained  $4\frac{1}{2}$  times in the total; the diameter of the eye is  $\frac{1}{2}$  of the length of the head; it occupies the upper third of the head; the distance from the muzzle is  $\frac{1}{2}$  of the length of the head; the distance across the arched forehead is  $1\frac{1}{2}$  diameter. The thick adipose fold covering the eye has a vertically elliptical aperture over the pupil. The first dorsal ray is excessively short and situated the length of one diameter of the eye behind the anterior third of the total length. The fourth and fifth are the longest,  $2\frac{1}{2}$  in the greatest vertical diameter of the body, which is contained  $3\frac{1}{2}$  to  $2\frac{3}{4}$  times in the total length. The upper margin of the fin is falciform; the posterior ray a little elongated; the extent of the base is  $\frac{1}{2}$  of the length of the head. The eleventh ray is exactly in the centre between the muzzle and the middle of the root of the caudal. The latter is deeply cleft; the lower lobe, a little longer than the upper, is a little less than the greatest vertical diameter of the body. The extent of the base of the anal slightly.

exceeds that of the dorsal; the last ray is a little elongated; the first ray is situated at equal distance from the root of the caudal and the last ventral ray. The first ventral ray is situated in the centre between the muzzle and the root of the caudal, opposite the second fourth of the dorsal;\* the length of the fin is  $\frac{1}{2}$  of the caudal; that of the elongated, triangular scale  $\frac{1}{2}$  of the longest ray. The pectorals extend nearly to the ventrals; their length is  $\frac{2}{3}$  of the head; the elongated axillary scale is  $\frac{1}{2}$  of the length of the fin. The sides are covered by 15 longitudinal series of scales, of which there are 39 or 40 between the gill-opening and the caudal. By these characters it may readily be distinguished from a closely allied species: *Alausa ilisha*, (Buchan. Ham.)† Small individuals are at Pinang very numerous during all seasons; larger ones less so, although by no means scarce. Like *A. ilisha* in Bengal, the present species is by the English of the Straits Settlements denominated: *Shad* or *Sablefish*, and is equally valued for its flavour. Both are, however, somewhat oily, very rich and bony. *Alausa toli* is remarkable as forming in the Indian Archipelago a distinct and important branch of fishery, principally for the sake of its roe. It is the kind of "*Shad*" to which Mr. Crawford refers as frequenting the great

\* M. Valenciennes refers Russell No. CXCV. *Xeles*, to the young of the present species, but the ventral fins are placed very far backwards, opposite the posterior fourth of the base of the dorsal. If therefore the figure of Russell is correct, it represents a species different from *A. toli*.

† SYN.: Russell CXCVIII. *Palasah*.—*Clupeodon ilisha*, Buchan. Ham. 243, 382, Tab. XIX. Fig. 73 (Young).—*Alosah palasah*, Cuv. R. A. II. 320 (!).—*Clupeodon ilisha*, Taylor; Gleanings of Science, II. 171.—*Alausa palasah*, Cuv. and Val. XX. 432.—*Alosa palasah*, Jerdon: Madras Journ. XV. 345. (Excl. Syn. *Clupea indica*, Gray).—The number of fin rays is: D 19, C 19 $\frac{1}{2}$ , A 19, V 8, P 14, 15 or 16, Br. VI. It has 19 longitudinal series of scales, of which there are 47 to 49 between the gill-opening and the caudal. Buchanan Hamilton gives: D 20, A 21, probably owing to his having counted the last double rays as single. Sir John Richardson quotes, not without doubt, a specimen in the British Museum as *Alosa palasah*, Russell 198? (Report 1845, 306). Forty scales form a longitudinal row, and there are fifteen rows in height; "the pectorals reach nearly to the ventrals, which are attached before the middle of the dorsal." These characters are sufficient to prove the species to be distinct from Russell's *Palasah*, while they agree with *Alausa toli*, Cuv. and Val. But Sir J. Richardson counts: D 16, A 18, P 15, V 9.



river Siak in Sumatra, and of which the dried roe, of enormous size, constitutes an article of commerce. (Crawford: *Hist. Ind. Archipel.* III. 440.—Boyle: *On the Production of Isinglass*, 76). A description of the fishing of this species is given by the late Mr. Moor in *Notices of the Indian Archipelago*, &c. p. 29. "At Bukit Batu,\* a place on the main of Sumatra within the Strait formed by the island of Bankalis, exists an extensive fishery well known in this part of the world. The fish which is the object of it is called in the Malayan language: *Trábu*. The fish itself is sufficiently known in all the neighbouring seas but found with a roe only here,† which makes it certain that it repairs to this favoured place for the purpose of spawning. The *Trábu*, about a cubit long, is taken in 3 and 4 fathoms water on a mud bank. About 300 boats are engaged at all seasons in the fishery with the exception of four days during dead neap tides. The roes are an article of trade seaways, and the dried fishes are sent into the interior of Sumatra. The Rajah of Siak draws a revenue from this fishery of 72,000 guilders yearly, receiving a certain duty upon the quantity taken. From the rate and amount of this duty it is ascertained that the quantity of fish caught yearly amounts to between fourteen and fifteen millions. It seems a little remarkable that the spirit of European monopoly never should have fastened upon so promising an object of gain. The fishery, from its peculiar nature, is probably quite inexhaustible, and might unquestionably be prodigiously improved by European skill and industry, and this too not only without detriment, but probably to the great improvement of the revenue of the native prince, as well as the essential benefit of the surrounding population." In the Malayan markets the roe is called "*Télur ikan*," the fish-roe "par excellence." Like the preparation of fermented fish and shell-fish: "*Balachean*," it is largely used by the Malays and Chinese to season and make their food palatable and it is no less a favourite relish with Europeans. W. T. Lewis, Esq. Resident Counsellor, Pinang, who has observed the process of preparation in Sumatra, describes it as follows. The fresh roe is thoroughly salted, and next partially dried, so as to retain a slight moisture, in which state it is by hundreds closely

\* Opposite to, and a little to the southward of Malacca.

† That is to say, in shoals, for it is plentiful at Pinang, Malacca and Singapore.

placed in casks, and thus exported. In our Malayan Settlements the price is from 3 to 4 Spanish Dollars per hundred. The dealers there export considerable quantities to China, after having taken the precaution to repack the roes between layers of salt, and to sprinkle them with arrack. To dress them, they are soaked for about half an hour in water, and then fried. As the roe appears in commerce, it is of an elongated flat shape, measuring from 6 to 8 inches in length, about 2 in breadth, and  $\frac{1}{2}$  of an inch in depth, of a deep amber colour. The single eggs are larger than those of *A. ilisha*.

**ALAUSA CHAMPIL, (Cuv. and Val.)**

(*Icon.*) Clupea champil, Gray : Ill. Ind. Zool. II. Pl. 91, Fig. 5 and 6.  
Pellona champil, Cuv. and Val. XX. 324.

Head above, back and upper third of the side pale sea-green, sparingly dotted with black ; rest of the body and head silvery with lilac reflections ; from behind the upper part of the opercle to the caudal a pale longitudinal lilac band, the upper margin of which pale silvery ; dorsal, anal and caudal yellowish white, the two first with a black dot at the root of each ray ; caudal minutely dotted with black ; rest of the fins hyaline. Iris silvery with lilac reflections.

D 16, C 19 $\frac{1}{2}$ , A 18, V 7, P 11, Br. VI.

**HABIT.**—*Sea of Pinang.*

**TOTAL LENGTH :** 3 $\frac{1}{2}$  inch.

The length of the head is  $\frac{1}{3}$  of the total ; the horizontal diameter of the orbit is a little less than  $\frac{1}{3}$  of the length of the head ; the distance across the forehead equals the diameter. The jaws are nearly equal ; the length of the upper slightly exceeds the diameter of the eye. There are no teeth in any part of the mouth. The greatest vertical diameter of the body, in front of the dorsal fin, is contained 3 $\frac{1}{2}$  times in the total length. The sides are covered by 11 longitudinal series of scales, of which there are about 42 between the gill-opening and the caudal. The abdominal line carries 29 fine species. The dorsal commences a little in front of the centre between the muzzle and the root of the caudal ; the fifth, the longest ray, is  $\frac{2}{3}$  of the length of the head and equal to the extent of the base. The upper margin is straight ; the last ray a little elongated. The caudal lobes are equal,  $\frac{1}{3}$  of the total length. The anal commences a little in front of the posterior fourth

of the distance between the muzzle and the root of the caudal; the length of the longest rays, the 4th, and 5th, is  $\frac{1}{2}$  of the 5th dorsal; the extent of the base slightly exceeds that of the dorsal. The first ventral ray is situated opposite the first dorsal ray, a little nearer the first pectoral than the first anal ray; the length of the fin is  $\frac{1}{2}$  of that of the head. The length of the pectorals is  $\frac{3}{4}$  of the head. Two individuals of equal length occurred together at Pinang in October 1843. Both strikingly resemble a drawing of Buchanan Hamilton's duplicate series, marked in Buchanan's hand writing: "*Clupea champil, B.*" This drawing is evidently the original of the indifferent copy in the *Illustr. of Indian Zool.*, which is the foundation of *Pellona champil*, Cuv. and Val. It is one of the few drawings which Buchanan has omitted to describe in his work upon the fishes of the Ganges.

GEN. ENGRAULIS, (Cuvier 1817) Valenciennes 1848.

Mouth cleft far behind the eyes; muzzle projecting, pointed; ethmoid bone advancing in front of the jaws; intermaxillaries soldered to the maxillaries, hid beneath the muzzle; vomer narrow with a few teeth on the anterior part; palatals and pterygoids narrow, bristling with minute teeth, or rough; gill-opening very large; body rounded or compressed like a knife-blade; abdomen trenchant or toothed.

ENGRAULIS BROWNII, (Gmelin).

"Menidia, corpore subpellucido," Brown: Jamaica 141, Tab. XLV.  
Fig. 3.

Argentina, Gronov. Zoophyl. 112, No. 350.

Atherina japonica, Houttuyn: Act. Haarl. XX. 340?

Atherina brownii, Linné: Syst. 1397.

Atherina australis, White: Voyage, 196, Fig. 1.

Atherina (*Clupea*) brownii, Bloch-Schneider.

Stolephore commersonien, Lacép. V. 382, Tab. XII. Fig. 1.

*Clupea vittargentea*, Lacép. V. 424, 458, 461, (*Excl. Syn.*)

Russel CLXXXVII. Nattoo.

Atherina menidia, Shaw V. 131.

Commersonian Atherine, *ibid*, Pl. 113, Fig. 1.

Atherina japonica, Shaw V. 132?

*Engraulis* (*Stolephore commersonian*), Cuv. R. A. II. (1817,) 175. (?).  
(1829,) 323. (?).

*Engraulis albus*, Swainson II. 293.

*Engraulis commersonianus*, Richardson : Report 1845, 308.

'Descript. of anim. 201, Fig. 149' ? *ibid*, 305, 309.

*Engraulis fasciata*, Cuv. and Val. XXII. 43.

*Engraulis brownii*, Cuv. and Val. *ibid*, 41.

*Engraulis commersonii*, Bleeker : Verh. Batav. Gen. XXII. 6.

Bunga ayer, or Bédah of the Malays.

Head above light greenish grey, a large oval blackish spot occupying the posterior half; back pale sea-green or greenish grey; sides and abdomen transparent greenish buff, or grey with reflections of mother-of-pearl; from the upper third of the gill-opening to the root of the caudal a broad longitudinal silvery band; cheeks and opercles shining silvery, the latter above dotted with black; caudal pale yellow, dotted with black, rendering the posterior margin blackish; rest of the fins hyaline. Iris silvery, orbital margin blackish.

D 14, 15 or 16, C 19½, A 20 or 21, V 7, P 15 or 16, Br. XI.

HABIT.—*Sea and estuaries of Malayan Peninsula and Islands.*

China sea, New Zealand, Madura, Java, Sumatra, Bombay, Coromandel, Bay of Bengal, Gangetic estuaries, Isle of France, Australia, New York, Havanah, Jamaica, Vera Cruz, Martinique, Barbadoes, St. Christopher, Rio Janeiro.

TOTAL LENGTH : 6 inch.

The head is  $\frac{1}{4}$  of the total length; the horizontal diameter of the eye is contained  $3\frac{1}{2}$  times in the length of the head; the distance across the forehead equals one diameter; the greatest vertical diameter, in front of the dorsal, is  $\frac{1}{4}$  less than the length of the head. The body is covered by 7 longitudinal series of deciduous scales, of which there are from 35 to 38 on the third series. On the anterior twelve scales of this series appears the lateral line which consists of a linear central tube, which disappears or becomes indistinct on the rest of the scales. The latter are diaphanous, rhomboidal, with their horizontal diameter  $\frac{1}{4}$  of the vertical. The dorsal commences nearly in the middle between the muzzle and the centre of the posterior margin of the caudal; the anal commences opposite the posterior third of the dorsal. The ventrals are situated in the middle

between the pectorals and the anal. The caudal is deeply cleft; the length of each lobe equals that of the head. In the Straits of Malacca as in the mouths of the Ganges, this species is astoundingly numerous at all seasons. Two to three inches is the usual length, five to six are very rarely seen. In fine weather swarms may be seen swimming near the water's edge, and making very short leaps closely above the surface of the sea. As Russell observes, they are highly valued for their delicate flavour when fried. In Java, Sumatra and the Straits of Malacca, large quantities are preserved both for home consumption and exportation to China and India. The delicious condiment is famed under the denomination of "*Red-fish*," (*Ikan mérah* of the Malays,) or "*Malacca-fish*," and is used as a relish. The following mode of preparation, as practised at Bencoolen and Malacca, has been communicated by W. T. Lewis, Esq. Asst. Res. Counsellor, Pinang. After the heads have been removed, the fishes (those of middling size are preferred), are cleansed, salted (in the proportion of one to eight parts of fish), and deposited in flat glazed earthen vessels. In the latter they are for three days submitted to pressure by means of stones placed on thin boards or dried plantain leaves. The fishes are next freed from salt and saturated with vinegar of Cocoa Palm toddy, after which are added powdered ginger and black pepper (the latter mostly entire), and some brandy and powdered "*Red rice*." After having been kept for three days, a little more vinegar is added before placing the fishes in well closed jars or bottles. They should be kept four or five months before being used. The expense of a quart bottle of the condiment is about 30 Cents, the selling price one Spanish Dollar. "*Red rice*" is the variety of *Oryza sativa* called *glutinosa* (*púlut*, or *bras sepúlut* of the Malays) steeped in an infusion of Cochineal. In the Straits Settlements red rice is imported from China, and sells at the rate of 10 Cents of a Dollar per lb. The Chinese settlers in the Straits prepare a similar red condiment with slices of *Polynemus indicus* and *P. tetradactylus* and also prawns.

(SETIPINNA, Swainson, 1839.—TELARA, Val. 1848.—*Anterior pectoral ray elongated, filamentous*).

ENGRAULIS BREVICEPS, Cantor.

Head and body reddish-golden or brass colour, back sparingly dotted with black; fins reddish yellow, like the body, but not metallic; anterior half of upper dorsal margin, and the posterior caudal margin broadly brimmed with black; posterior fifth of the anal margin equally so. Iris reddish golden.

D 1/16, C 19 $\frac{3}{8}$ , A 63, V 7, P 13, Br. XVI—XVI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 9 $\frac{1}{8}$  inch.

The head is strikingly short; the distance from the muzzle to the upper part of the posterior margin of the opercle is contained 8 $\frac{1}{2}$  times in the total, (measured to the occiput, it is  $\frac{1}{15}$  of the total.) The horizontal diameter of the eye is  $\frac{1}{4}$  of the length of the head; the distance across the forehead is a little less than two diameters. The greatest vertical diameter of the body, in front of the dorsal, is  $\frac{1}{4}$  of the total length. The dorsal commences in the centre between the muzzle and the root of the caudal; the first soft ray is preceded by a short strong spine. The anal commences in front of the dorsal, opposite the second third of the total; the extent of the base of the anal is 2 $\frac{1}{4}$  in the total. The upper caudal lobe is truncated. The ventrals are situated in the centre between the first ray of the pectorals and the anal. The first pectoral ray is a little less than 2 $\frac{3}{4}$  times in the total length; it does not reach the middle of the anal. The second pectoral ray slightly exceeds  $\frac{1}{2}$  of the first. This species nearest approaches *E. telara*, (Buchan. Hamilton). A single individual was observed at Pinang in August 1844.

ENGRAULIS TATY, Cuv. and Val.

Engraulis taty, Cuv. and Val. XXI. 60.

Head above and back greyish green or greenish slate colour, sparingly dotted with black; sides above the lateral line pale silvery green; the rest, abdomen, cheeks and opercles silvery; dorsal, caudal and anal yellow; ventrals and pectorals hyaline; in some the posterior caudal margin blackish. Iris silvery, orbital half bluish black.

D 1/14, C 19 $\frac{3}{8}$ , A 52 to 56, V 7, P 16, Br. XIII—XIII.

**HABIT.**—*Sea of Pinang, Malayan Peninsula.*

*Malabar, Pondicherry.*

**TOTAL LENGTH:** 6 inch.

Measured to the upper part of the posterior margin of the opercle, the length of the head is contained  $6\frac{2}{3}$  times in the total, (to the occiput it is  $9\frac{2}{3}$  in the total.) The horizontal diameter of the eye is  $\frac{1}{2}$  of the length of the head; the distance across the forehead is  $1\frac{1}{2}$  diameter. The greatest vertical diameter of the body, in front of the dorsal, is  $4\frac{1}{2}$  in the total length. The dorsal commences a little in front of the middle between the muzzle and the root of the caudal. The anal commences opposite the centre of the dorsal; the extent of the base is  $2\frac{2}{3}$  in the total length. The ventrals are situated in the centre between the first pectoral and the fifth anal ray. The upper caudal lobe is truncated. The first pectoral ray is  $1\frac{1}{2}$  in the total length: it reaches to the posterior third of the anal; the second pectoral ray is  $3\frac{1}{2}$  in the length of the first. Single individuals occur at Pinang at all seasons, and are eaten either fresh or dried by the natives.

(*THEISSA*, Rafn. 1815.—*Maxillaries greatly elongated.*)

**ENGRAULIS MYSTAX**, (Bloch-Schneider).

*Clupea mystax*, Bl. Schn. 426, No. 14, Pl. 83.

*Thryssa mystax*, Cuv. R. A. II. 323 (?).

*Thryssa mystax*, Richardson: Report, 1845, 309 (*Excl. Syn. Clupea malabarica and Poorawah, Russell, 189?*)

*Engraulis mystax*, Cuv. and Val. XXI. 67.

Head above and back dark bluish green; lighter silvery on the sides above the lateral line; behind the upper part of the gill-opening a triangular spot, composed of horizontal, black, dotted lines, downwards increasing in length; rest of the sides and abdomen silvery white; cheeks and opercle silvery with golden reflections; dorsal and caudal whitish yellow, marginal half minutely dotted with black; rest of the fins whitish transparent. Iris silvery, orbital margin bluish black.

D 1/13, C  $19\frac{2}{3}$ , A 37, 38 or 39, V 7, P 14, Br. XII.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Singapore.*

*Bombay, Malabar, Coromandel, Gangetic estuaries.*

**TOTAL LENGTH:** 8 inch.

The length of the head is  $\frac{1}{2}$  of the total. The horizontal diameter of the eye is  $\frac{1}{2}$  of the length of the head; the distance across the forehead is  $1\frac{1}{2}$  diameter. The greatest vertical diameter, in front of the dorsal, is  $\frac{1}{2}$  of the total length. The upper jaw extends beyond the root of the pectorals. The dorsal commences a little behind the centre of the distance between the muzzle and the root of the caudal fin. The caudal lobes are equal, pointed, and as long as the head. The anal commences opposite the posterior third of the dorsal; the extent of its base is contained about  $3\frac{1}{2}$  times in the total length. The ventrals commence nearer the pectorals than the anal, their distance from the symphysis of the lower jaw is  $2\frac{1}{2}$  in the total length. The pectorals are  $\frac{1}{2}$  shorter than the head; placed in contact with the sides, their apex extends to the last ray of the ventrals. At Pinang single individuals occur at all seasons and are eaten by the natives. Sir John Richardson considers *Clupea malabarica*, Bloch. (Pl. 432.—Bl. Schn. p. 425) and *Poorawah*, Russell, CLXXXIX, to be identical with the present species. But according to the description of *Engraulis malabarica*, (Cuv. and Val. XXI. 63, Pl. 609) the upper jaw extends very little beyond the margin of the opercle, and does not extend as far as the pectorals, and the latter barely touch the root of the ventrals. The figure of *Poorawah* is scarcely correct enough, nor the description (Russell, p. 72) sufficiently explicit to determine the species.

Dr. Bleeker has described a new species under the inadmissible name of *Thryssa porava*, which he with doubt refers to *Poorawah*, Russell, CLXXXIX. (Bleeker: *Bijdrage tot Ichth. Fauna van Madure*, in: *Verh. Batav. Genoots.* XXII. p. 14.)

#### ENGRAULIS PURAVA, (Buchan. Hamilton).

Russell CXC. Peddah Poorawah.

*Clupea purava*, Buchan. Hamilt. 238, 382.

*Thryssa* (Pedda Poorawah) Cuv. R. A. II. 323 (?).

*Thryssa megastoma*, Swainson, II. 293.

*Engraulis purawa*, Cuv. and Val. XXI. 65.

Head above and back dark bluish green; lighter silvery above the lateral line; rest of the sides, abdomen, cheeks and opercles silvery; fins coloured like those of *E. mystax*. Iris silvery; orbital margin bluish black.

D 1/13, C 19 $\frac{1}{2}$ , A 43, 45 or 46, V 7, P 14, Br. XII.



HABIT.—*Sea of Pinang.*

Coromandel, Gangetic estuaries, Java, Madura.

TOTAL LENGTH: 8 inch.

The length of the head is  $\frac{1}{3}$  of the total. The horizontal diameter of the eye is contained  $4\frac{1}{2}$  times in the length of the head, the distance across the forehead is  $1\frac{1}{2}$  diameter. The greatest vertical diameter, in front of the dorsal slightly exceeds  $\frac{1}{2}$  of the total length. The maxillaries are narrower and longer than in *E. hamiltoni*, where they reach to the root of the first pectoral ray; in the present species they reach to the root of the posterior pectoral ray. The dorsal commences a little in front of the centre between the muzzle and the root of the caudal; the anal commences in the centre of that space, opposite the middle of the dorsal. The extent of the base of the anal is  $\frac{1}{3}$  of the total length. The caudal lobes are equal, pointed, and as long as the head. The pectorals are a little shorter. The ventrals are situated a little nearer the pectorals than the anal. At Pinang this species appears to be of uncommon occurrence.

GEN. COILIA, (*Gray, 1831.\**) *Cuv. and Val. 1848.*

(TRICHOSOMA, TRICHOSOMUS, *Swainson, 1839.*—CHÆTOMUS, *McClelland, 1843.*)

Gape wide; gill-opening very open; muzzle projecting, supported by the ethmoid bone; upper maxillaries free, projecting beyond the opercle, and in some species reaching the root of pectorals; dorsal placed on the anterior part of the back; body elongated, compressed, tapering to a pointed tail; anal joining the caudal, elongated, low, but in one species tail shortened and caudal widened, rounded; above the pectoral two groups of filaments, parting from a common base; in general characters like *Engraulis (Thrissa)*, but the anterior pharyngeals are more distinctly, though minutely, toothed.

\* *Zool. Misc. 9.*—Mr. Gray's characters are: "Body tapering, compressed; dorsal fin short, over the ventrals; anal and caudal fin united; pectoral fins small; rays five; three upper long and free; rest of the characters like *Thrissa*."

## COILIA REYNALDI. Cuv. and Val

*Coilia reynaldi*, Cuv. and Val. XXI. 81. (*Young.*)

*Adult.* Pale golden throughout; head above and back sparingly dotted with black; from the middle of the gill-opening towards the tail a series of distant rounded spots of shining or burnished gold; in some individuals a second shorter series from the root of the pectorals to opposite the anterior third of the anal; fins reddish yellow; upper half of dorsal sparingly dotted with black, caudal and margin of the anal blackish. Iris golden, orbital half black; pupil circular, but the aperture of the adipose orbital membrane horizontally elliptic.

D 1/15, C 11, A 107 to 116, V 7, P  $\frac{IV}{11}$ , Br. X.

HABIT.—*Sea and estuaries of Pinang, Malayan Peninsula, Singapore.*

Rangoon.

TOTAL LENGTH: 7 inch.

The length of the head is  $\frac{1}{4}$  of the body, the caudal not included, or  $6\frac{1}{2}$  in the total. The horizontal diameter of the eye is  $\frac{1}{4}$  of the length of the head; the distance across the forehead is  $1\frac{1}{2}$  diameter. The upper maxillaries reach but halfway between the angle of the lower jaw and the root of the pectorals. The greatest vertical diameter, in front of the dorsal, is contained from  $5\frac{1}{2}$  to  $5\frac{2}{3}$  times in the total length. The dorsal, preceded by a short, strong spine, commences a little in front of the second fourth of the total length; the first divided ray (the fifth of the fin,) terminates in a filament, which, however, from its slenderness is frequently broken. The ventrals are situated opposite the commencement of the dorsal, a little nearer the pectorals than the anal. The latter commences a little behind the dorsal, at the second third of the total length. The extent of the base of the anal is  $1\frac{3}{4}$  in the total length, in which the distance from the muzzle is  $2\frac{1}{4}$ . The four pectoral filaments are contained  $3\frac{1}{2}$  times in the total length and reach a little behind the commencement of the anal; the second ray is divided in two, the other three are simple. The length of the pectoral rays does not exceed  $\frac{2}{3}$  of the head. The caudal is pointed. At Pinang single individuals occur at all seasons, and like the rest of the *Clupeoidæ*, are eaten by the natives either fresh or dried.

## GEN. CHATOESSUS, Cuvier, 1829.

Mouth small, without teeth; muzzle projecting; on the upper jaw a notch and a corresponding tubercle on the lower; the superior combs of first branchial arches unite with those of the opposite side, forming a pennated point under the palate; body short, deep, oval; in some species the posterior dorsal ray elongated.

## CHATOESSUS CHACUNDA, (Buchan. Ham.)

*Clupanodon chacunda*, Buchan. Ham., 246, 383.

*Chatoessus chacunda*, Cuv. and Val. XXI. 111.

Head above and back sea-green, minutely dotted with black; sides and abdomen silvery or pale golden; the centre of the scales of the upper third of the sides minutely dotted with black, forming five very pale blackish longitudinal lines; behind the upper part of the opercle a large black spot; cheeks and opercles golden; caudal yellow, sparingly dotted with black; rest of the fins hyaline whitish; dorsal dotted with black. Iris golden dotted with black.

D 19, C 19 $\frac{1}{2}$ , A 20, V 7, P 15, Br. VI.

HABIT.—*Sea of Pinang, Malayan Peninsula.*

Moluccas, Java, Malabar, Gangetic estuaries.

TOTAL LENGTH: 6 inch.

The length of the head is contained 4 $\frac{2}{3}$  times in the total. The horizontal diameter of the eye is  $\frac{1}{4}$  of the length of the head; the distance across the forehead slightly exceeds one diameter. The greatest vertical diameter, in front of the dorsal, is 2 $\frac{2}{3}$  in the total length. The body is covered by 13 longitudinal series of scales, the horizontal diameter of which is about  $\frac{1}{3}$  of the vertical. A series between the gill-opening and the caudal contains from 36 to 39 scales. The dorsal occupies the last of the anterior half of the total length; the fourth ray, the longest, equals the extent of the base, which is  $\frac{2}{3}$  of the head; the last ray is  $\frac{1}{4}$  of the fourth. The caudal is deeply cleft; the posterior margin of each lobe is arched; the length is 3 $\frac{2}{3}$  in the total. The first ray of the anal is placed at equal distance from the first ventral and the root of the caudal; the fin is very low; its extent equals that of the dorsal. The ventrals are placed opposite the middle of the dorsal. The pectorals are  $\frac{1}{2}$  of the length of the head. Single individuals occur, but rarely, at Pinang.

## SUBORDO PHYSOSTOMI APODES.

## FAM. MURÆNOIDÆ.

GEN. CONGER. *Cuvier*, 1817.(MURÆNESOX, *McClelland*, 1843.\*)

The dorsal commences very near, or even above the pectorals; in all species known the upper jaw is the longer.

CONGER TALABON, *Cuvier*.

Russel, XXXVIII. Tala Bon.

Conger (*Muræna*) talabon, *Cuv. R. A.* 350. (\*).*Murænesox lanceolata*, *McClelland*, *Calc. Journ. Nat. Hist.* IV. 409.*Murænesox exodon*, *McClelland*, *ibid.**Murænesox serradentata*, (*Russell*, XXXVIII.) *McClelland*, *ibid.**Murænesox exodentata*, *McClelland*, *Calc. Journ. Nat. Hist.* V. 180,Pl. VIII. Fig. 4, and page 210, "*Pl. VI. Fig. 3*" (*erroneous reference*).

*Murænesox lanceolata*, *McClelland*, *ibid.* 181 "*Pl. VI. Fig. 3*" (*erroneous reference*) and page 210, "*Pl. VI. Fig. 3*" (*erroneous reference*).

*Murænesox serradentata*, *McClelland*, *ibid.* 210.Conger talabon, *Bleeker*: *Verh. Batav. Gen.* XXII. 6.

Head above, back and sides above the lateral line golden greenish or brownish-olive, minutely dotted with black; upper lip, cheeks, opercles and lower half of the sides lighter golden olive; under lip, throat and abdomen milk-white; dorsal, caudal and posterior half of anal pale olive, transparent, minutely dotted and edged with black; anterior half of anal transparent white; pectorals transparent yellowish. Iris golden.

Young individuals, frequenting estuaries, are of darker, less golden colours.

\* "*Absence of tubular nostrils*" is given as a character distinguishing *Murænesox* from *Conger*. The character, however, is incorrect, as in all the supposed species of *Mr. McClelland* the anterior apertures of the nostrils are provided with a tube, which is very distinct in the living fish.

D 238 to 286, }  
 C 9 to 11, } P 16, Br. XV.  
 A 151 to 129, }  
 398 to 426

HABIT.—*Sea and estuaries of Malayan Peninsula and Islands.*

Coromandel, Tenasserim, Coast of Arracan, Bay of Bengal,  
estuaries of the Ganges, Sumatra, Java, Madura.

TOTAL LENGTH : 7 ft. 5 inch.

The general form of the body is cylindrical, the anterior half slightly compressed, the posterior more so and tapering; the head is elongated conical, terminating in a narrow rounded muzzle near which in the upper jaw appears a wide notch, which receives the long conical teeth near the symphysis of the lower jaw. The length of the head, measured to the gill-opening, is  $\frac{1}{4}$  of the body, not including the caudal, which latter varies from  $\frac{1}{4}$  to  $\frac{1}{2}$  of the length of the head. The distance from the muzzle to the anterior margin of the orbit varies from  $3\frac{1}{2}$  times in to  $\frac{1}{4}$  of the length of the head. The distance across the notch of the upper jaw is  $\frac{1}{2}$  of the horizontal diameter of the orbit; between the anterior margins of the orbit it is  $\frac{2}{3}$ , between the posterior margins, it equals the horizontal diameter of the orbit. The latter is  $\frac{1}{3}$ , or a little less than  $\frac{1}{2}$  of the distance from the muzzle to the anterior margin of the orbit.\* The latter margin is situated in front of the centre of the distance between the muzzle and the angle of the mouth, which distance is a little less than  $\frac{1}{2}$  of the length of the head to the gill-opening. The anterior aperture of the nostrils is oval, provided with a short, yet very distinct tube; it is situated immediately above the lip, at the termination of the notch, a little in front of the centre between the muzzle and the anterior margin of the orbit. The posterior aperture is linear, or more elongated oval than the anterior, with the margin slightly raised, but not tubular; it opens a little in front of the eye at a distance from the anterior aperture equal to that of the latter from the muzzle. On each side of the crown of the head, a little farther

\* In the larger, upper figure of the head in *Calc. Journ. of Nat. Hist.* V. Pl. VIII. Fig. 4, the eye is represented too small, and is placed too far back; in the smaller figure the eye is correctly placed, but the gill-opening is much too near the angle of the mouth. These disproportions materially affect the position of the dorsal and pectoral fins in the figure.

back than the angle of the mouth, appears a transversal series of 8 to 10 pores; from the middle of each series proceeds forwards another shorter, longitudinal one, consisting of 3 to 5 pores. The distance from the muzzle to the angle of the mouth is one longitudinal diameter of the eye less than one half of the length of the head. The lips are thin, membranous, and closely adhering to the jaws. In the upper jaw appear three very close series of small conical teeth with the apex compressed and trenchant. The external series is excessively minute, and extends from the angle of the mouth to beneath the middle of the eye; the teeth of the second are about double the size of the former, with which they are in close contact, but they extend farther forwards to between the nasal apertures, where they coalesce with the external series of the teeth of the vomer; the third, internal, series consists of excessively minute conical teeth, distant among themselves and a little removed from the second series; they extend as far as the external series. Immediately in front of the notch the muzzle forms a small round space, the margin of which is armed with 4, 5, or 6 distant conical teeth, which are about  $\frac{1}{3}$  of the diameter of the eye. From the middle of the muzzle commences a short single series of 6 or 7 small conical teeth; which, as they continue along the middle of the vomer, become distant, much longer, compressed towards the apex and with trenchant margins. The number of these teeth varies with age from 7 to 15, of which the longest are about  $\frac{1}{3}$  of the diameter of the eye. In young individuals the two or three posterior ones are much compressed and tricuspidate. From the first long tooth commences a single close series of teeth which continue on each side of the vomer, but join each other a little behind the central series, which terminates between the eyes. The marginal teeth of the vomer are a little larger than the middle series of the jaw which they resemble in form. The lower jaw is much shorter than the upper: the symphysis is widened into a small rounded disk, on each side of which appear two or three long, distant, conical teeth, situated within the external series. The latter consists of much smaller outwards directed, distant, conical teeth, which beneath the eye decrease and become much closer. The middle series, headed by the longer ones behind the symphysis, consists of close, erect, conical teeth, with compressed trenchant apex. From beneath the eye the interval between the external and middle

series is filled by a short series of minute conical teeth. The third internal series is also minute, and extends from the angle of the mouth to a little in front of the posterior half of the jaw. The tongue is small, elongated, and tied to the floor of the mouth; it extends to a little in front of the posterior third of the mouth. The vertical diameter at the occiput equals the distance from the muzzle to the posterior nasal aperture, or it is contained from  $4\frac{1}{2}$  to 5 times in the distance from the muzzle to the gill-opening. The greatest vertical diameter of the body is  $\frac{3}{4}$  of the distance from the muzzle to the gill-opening; the smallest, in front of the caudal, is  $\frac{1}{2}$  of the latter. The lateral line commences from the side of the occiput, gently declining towards the end of the anterior fourth of the body, from whence it continues a little above the middle of the side straight to the caudal. It is composed of a series of tubes placed in pairs one above the other, none exceeding in length  $\frac{1}{2}$  the diameter of the eye. Each lower tube sends two branches obliquely downwards, and between these branches appears a pore. The dorsal commences a little in front of the gill-opening, at a distance from the base of the upper pectoral ray of  $\frac{1}{2}$  of the length of that fin. The dorsal and anal rays are undivided. All the fins present the peculiarity of having double rays; they appear to be single, but are composed of two distinct ones placed transversely, and kept by the fin-membrane so closely in contact, that each pair can act like a single ray. The caudal is closely united with the dorsal and anal, from both of which it may be distinguished by its much slenderer, branched, rays; their length either equals or slightly exceeds that of the dorsal rays. The anus is situated in front of the middle, either at, or a little behind the end of the fifth-twelfth of the total length. The anal fin commences immediately behind the vent; the rays are  $\frac{2}{3}$  of those of the dorsal. The pectorals are elongated, with branched rays; their length equals the distance from the muzzle to the posterior margin of the orbit. The skin is smooth and naked.

The description and figure of Russell are sufficient, easily to identify the species, which Mr. McClelland has renamed *Muraenesox serradentata* and described as having serrated teeth on the vomer. This error would appear to originate in a singular misinterpretation. Russell describes the jaws: "in both there are long crooked teeth in front, with a regular row of straight teeth in the upper jaw, *which is* rough on both sides like a file." Russell could not have chosen a more

correct simile of the roughness of the upper jaw of the young individual he had before him, but he says nothing of the teeth being serrated. *Muraenesox exodentata*, McClelland, differs in no one character from *serradentata*, but the description is inaccurate as far as concerns the dentition, the anterior aperture of the nostrils, and the lateral line. Nor is *Muraenesox lanceolata*, McClelland, different from either of the preceding, but the dentition and anterior nasal apertures are incorrectly described.

*Conger talabon* is in the Straits of Malacca, numerous at all seasons, but individuals exceeding 3 to 4 feet are less common. The Malayan denominations of *ikan ular*, (i. e. fish-snake,) and *madang* are indiscriminately applied to eels, all kinds of which are eaten by the natives. The heart is situated immediately behind the gill-openings. The oesophagus extends as far behind the latter as the distance from the muzzle to the angle of the mouth. The stomach is a narrow cylinder about  $\frac{1}{3}$  of the total length, extending to the anus; the coats are thick and firm, with longitudinal folds on the internal surface. The intestine is a simple cylindrical canal, thinner than the stomach; the posterior part is a little tortuous, which makes it a little longer than the stomach. The liver is bilobate, very short, of a brownish yellow colour; it commences from the apex of the heart, and adhering to oesophagus, it terminates at the origin of duodenum, where the short, straight cystic duct enters. The gall-bladder is small, oval, of a greenish white colour. The spleen is short, linear, adhering to duodenum, of a pale crimson colour. The air-vessel is elongated, spindle-shaped, not exceeding the diameter of the stomach; it commences above the cardia, follows the stomach, but extends behind the anus in a cavity in the tail; the length is about  $\frac{1}{3}$  of the total; the coats are very thin, transparent silvery white.

#### CONGER BAGIO, (Buchanan Hamilton.)

*Muraena bagio*, Buchan. Ham. 24, 364.

*Conger longirostris*, Bennett: Life of Raffles, 692.

*Muraenesox tricuspidata*, McClelland: Calc. Journ. N. H. IV. 409,

Pl. XXIV. Fig. 1, a. b.

*Muraenesox hamiltonii*, (M. bagio,) McClelland: Calc. Journ. N. H.

V. 182, Pl. VIII. Fig. 3, and page 210.



*Muraenesox bengalensis*, McClelland, *ibid.* 182.

*Congrus tricuspidatus*, Richardson : *Ichth. of Sulph.* 105, Pl. 51,  
Fig. 2.

*Congrus tricuspidatus*, Richardson, Report, 1845, 312.

*Conger hamo*, Temminck et Schlegel : *Fauna Japon. Pisc.* 262, Pl.  
CXIV. Fig. 2.

Colours exactly like those of *C. talabon*.

|               |                       |
|---------------|-----------------------|
| D 238 to 245, | } P 15 to 18, Br. XX. |
| C 9 to 11,    |                       |
| A 198 to 211, |                       |
| 445 to 467.   |                       |

**HABIT.**—*Sea and estuaries of Malayan Peninsula and Islands.*

Japan, Chusan, Ningpo, Canton, Coromandel, Bay of Bengal, Tenasserim, Gangetic estuaries.

**TOTAL LENGTH :** 5 ft.

The general form resembles that of *C. talabon*, but it is less slender, the muzzle less elongated, the eye larger, the teeth of the vomer and some of those of the lower jaw are tricuspidate; the dorsal and anal extend farther forwards; the pectorals and caudal are shorter, and the branchiostegous rays more numerous. The length of the head, from the muzzle to the gill-opening, is contained from  $6\frac{1}{2}$  to  $6\frac{1}{3}$  times in the total length. The distance from the muzzle to the anterior orbital margin is  $\frac{1}{4}$  of the length of the head. The distance across the notch of the upper jaw equals the horizontal diameter of the eye, which is  $\frac{1}{2}$  of the length of the muzzle; the distance between the anterior margins of the orbits is  $1\frac{1}{2}$ , between the posterior margins it is two diameters. The eye occupies the third-eighth of the head; the anterior margin of the orbit is situated at the posterior third of the distance from the muzzle to the angle of the mouth; the length of the mouth is contained  $2\frac{1}{2}$  to  $2\frac{1}{3}$  times in that of the head. The anterior, tubular, aperture of the nostril opens at the end of the anterior third of the distance between the muzzle and the eye; the posterior occupies the commencement of the posterior third of that distance. The pores of the crown of the head are very indistinct. The general distribution of the teeth resembles that of *C. talabon*, but the teeth themselves present the following differences. Those of the mesial line of the vomer are compressed, with trenchant edges and tricuspidate; the central cusp is much larger than that at

the root of the anterior and posterior margin. They resemble the teeth of certain sharks, and are placed at intervals; more than from 5 to 7 are seldom present. Of the three longest, in the middle of the vomer, none exceeds  $\frac{1}{3}$  of the horizontal diameter of the eye; their breadth is  $\frac{1}{2}$  of the length. Of the three single series on each branch of the lower jaw the external and internal are equally minute and close. The middle series are much larger, tricuspidate, compressed and trenchant. The tongue resembles that of *talabon*, but the upper lip between the notch and the eye is fleshy, and covered with minute pointed lobes of the skin, which resemble velvety teeth; otherwise the lips present no difference. The vertical diameter at the occiput equals the distance from the muzzle to the eye,  $\frac{1}{4}$  of the length of the head, of which the greatest diameter of the body is  $\frac{1}{3}$ . The tail is more tapering than in *talabon* so that the vertical diameter in front of the caudal is from  $\frac{1}{10}$  to  $\frac{1}{12}$  of the greatest diameter of the body. All the fin-rays are double. The pectorals are rounded; their length is  $\frac{1}{4}$  of the head. The dorsal commences more in front of the gill-opening than in *talabon*, at a distance from the root of the upper pectoral ray of from  $\frac{1}{2}$  to  $\frac{2}{3}$  of the length of that fin. The longest dorsal rays are  $\frac{1}{3}$  to  $\frac{1}{2}$  of the greatest vertical diameter of the body. The caudal is so closely joined to the dorsal and anal, that the rays cannot be distinguished but by their position; their length is about  $\frac{1}{2}$  of the longest dorsal. The anus opens at, or a little in front of, the end of the second fifth of the total length. The fin commences immediately behind the anus; the longest rays scarcely exceed  $\frac{1}{2}$  of the dorsal ones.

The description of *Muraena bagio*, a drawing in Buchanan's duplicate series thus marked in his own hand-writing, and comparison of individuals from the Straits of Malacca and Calcutta prove the identity of the species. Those from the latter locality are of a darker olive colour, and not golden like those frequenting the sea. Buchanan has observed the strong resemblance of *bagio* and *Taloo Paum*, Russell, No. XXXVI. p. 25. In the not very explicit description of the latter, the upper jaw is characterised as being "somewhat shorter than the lower," which, if correct, militates against the identity of the two. *Muraenesox tricuspidata*, McClelland, offers no character different from *bagio*, but the dentition is incorrectly described. Such is also the case with *Muraenesox bengalensis*, McClelland. Of Buchanan's drawing of *Mu-*

*ræna bagio*, (*Muraenesox hamiltonii*, McClelland,) an incorrect copy is given in *Calc. Journ. of Nat. Hist.* Pl. VIII. Fig. 3.\* This species Mr. McClelland observes he never met; yet the short description of *Muraenesox bengalensis*, McClelland, differs from the former in no essential character, except in the number of fin rays, which comparison proves is liable to considerable individual variations in the present species as well as in *talabon*. Buchanan himself is doubtful about the correctness of his number of rays of *bagio*. *Conger hamo*, Temminck et Schlegel, from Japan, only differs in the colours of the body which above is greyish brown, and in having the iris silvery. In the Straits of Malacca young individuals of *Conger bagio* are as plentiful as *talabon*. Both are fierce and of voracious habits, preying upon fishes and crustacea, and their bite is dreaded by the fishermen.

The anatomy of this species offers some slight differences from *C. talabon*. The heart is situated nearer the head, immediately above the gill-openings. The œsophagus extends but as far behind the latter as half the distance from the muzzle to the angle of the mouth. The cylindrical stomach extends to the anus and is  $\frac{1}{2}$  of the total length, of which the intestine is  $\frac{1}{3}$ . The right lobe of the liver is a little larger than the left. The pearl-coloured coats of the spindle-shaped air-vessel are thick, not transparent; the length is contained a little more than  $2\frac{1}{2}$  times in the total.

#### GEN. OPHIURUS, Lacépède, 1800.

(LEPTOGNATHUS,† Swainson, 1838.—OPHITHORAX,‡ McClelland, 1844).

Dorsal and anal terminating before reaching the end of the tail, which is without fins, terminating like a puncheon; posterior aperture of the nostril opens on the margin of the upper lip.

\* The drawing was first inscribed "*Ophiuroides*," afterwards altered by Buchanan himself to "*Muraenophis bagi*." It represents the fish stretched, and thus correctly gives the proportions. In Mr. McClelland's copy above quoted the fish is doubled, by which some of the proportions are lost, and the apertures of the nostrils are incorrectly copied.

† *Classif. of Fishes*, I. 221, Fig. 42; II. 334.

‡ (SER. OPHIOTHORAX.) *Calcutta Journal, Nat. Hist.* V. 173 and 212.

A *With globular teeth.*

OPHIURUS BACCIDENS, Cantor.

Plate V. Fig. 1. (Natural size.)

Head above and back dull greenish olive ; lighter on the sides, dotted with brown ; throat and abdomen greenish- or bluish white ; fins pale olive-grey or white, dotted with brown ; dorsal edged with black. Iris golden greenish olive ; pupil horizontally lanceolate.

D 259 to 271, A 167 to 180, P 17, Br. XXXIV.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

TOTAL LENGTH : 3 feet.

The general form is thick, heavy ; the head broad, the muzzle short, depressed, pointed ; the body cylindrical ; the tail gradually compressed and tapering to a short point. The length of the head, from the muzzle to the gill-opening, is contained from  $8\frac{1}{2}$  to  $8\frac{3}{4}$  times in the total. The distance from the muzzle to the anterior orbital margin is  $\frac{1}{2}$  of to  $6\frac{1}{2}$  times in the length of the head ; the eye, bordering upon the forehead and the lip, occupies the third-eleventh of the length of the head ; the distance between the anterior orbital margins is  $1\frac{1}{3}$ , between the posterior ones it is 2 horizontal diameters of the eye. The posterior orbital margin is situated a little in front of the angle of the mouth, the distance between which and the muzzle is contained  $3\frac{1}{2}$  times in the length of the head. On each side of the crown of the head, from between the eyes to the muzzle, appears a series of four distant pores ; behind each eye are three such vertically placed on each side, on the occiput two, along each side of the upper lip five or six, and beneath each branch of the lower jaw six such pores. The upper lip is fleshy, and lax, and gives the symphysis a more rounded outline than it really has. On each side of the symphysis opens the anterior nasal aperture through a voluminous tube. The posterior apertures perforate the lower surface of the lip ; they are linear, terminating obliquely outwards beneath the anterior orbital margin, and have a valve on the external margin ; their length is  $\frac{1}{2}$  of the diameter of the eye. About midway between the anterior and posterior apertures appears a small pointed lobulet, and a smaller one immediately behind the posterior aperture. The middle of the lower surface of the point of the muzzle is occupied by a rounded cluster, (nearly of the size of the eye,) of globular teeth, like minute pearls, of which two or three in the centre are

a little larger than the rest. A little behind this cluster commence the teeth of the middle line of the palate which resemble the former, and are arranged in the shape of a short dagger. On each side of the jaw is an elongated, pointed and backwards diverging band of teeth. They commence with a narrow interval from the handle of the dagger and are all globular, except a single series of minute pointed teeth along the internal margin of each band. The lower jaw is one diameter of the eye shorter than the upper, leaving uncovered the point of the muzzle with its teeth and the nasal tubes. The teeth resemble those of the upper jaw with a similar internal series of pointed ones; the band of each branch is separated by a narrow interval on the symphysis. The tongue is oval and tied to the floor of the cavity extending but little in front of the posterior third of the mouth. The vertical diameter at the occiput is  $\frac{1}{3}$ , at the anus  $3\frac{1}{3}$ , at the termination of the dorsal and anal  $\frac{1}{16}$  of the length of the head. All the fin rays are double; those of the dorsal and anal undivided. The rounded pectorals are placed obliquely a little behind the gill-opening; their length is  $\frac{1}{2}$  of the head; the distance from the muzzle to the root of the upper ray is contained  $8\frac{1}{2}$  times in the total length. The dorsal commences above the end of the anterior third of the pectorals and terminates rather abruptly at a distance from the compressed point of the tail equal to the diameter of the eye; the largest rays do not exceed the distance from the muzzle to the anterior orbital margin. The anus opens two diameters of the eye behind the termination of the second fifth of the total length. The fin commences immediately behind the anus, and terminates opposite the dorsal which it resembles in length. The lateral line commences from the side of the occiput, occupying the upper third of the side till it reaches the anus, from whence it continues in the middle to the point of the tail. Beneath it is accompanied by a series of pores, one diameter of the eye distant from each other. This species is numerous at all seasons. In external appearance it resembles *O. cancrivorus*, Richardson (*Zool. Erebus and Terror, Fishes*. Pl. 50, Fig. 6,) but the latter is more slender, the teeth of the jaw and palate appear in front to coalesce; there are no pores behind the eyes, but four along each branch of the lower jaw. The heart is placed immediately behind the gill-openings. The apex of the heart is clasped by the bifid anterior extremity of the broad, thick,

single-lobed liver which extends to cardia and pylorus; it is of a brownish lake colour; the small gall-bladder is almost entirely imbedded in the substance of the liver. Both cardia and pylorus are situated at the end of the second eleventh of the total length. The cylindrical elongated stomach extends to within a short distance from the anus; the anterior third portion is thick, muscular, with internal longitudinal folds; the rest of the sac is membranous, without folds, and widened at the transition. The duodenum is wider than the rest of the canal, the length of which is  $\frac{1}{3}$  of the total. The pale crimson spleen is short, linear, adhering to the duodenum. The silvery-white air-vessel is linear, spindle-shaped; it commences a little in front of the posterior half of the distance between the muzzle and anus, at the origin of the membranous portion of the stomach and extends but a little into the cavity of the tail. The latter terminates as far behind the anus as the anterior half of the total length. The cavity contains the bluish grey kidneys, which extend but a little in front of the anus, and the ovaries, which farther occupy nearly the whole length of the abdominal cavity, and extend to halfway between the pylorus and the heart. The ova are very minute of a whitish yellow colour.

OPHIURUS BORO, Buchanan Hamilton.

Plate V. Fig. 2, (Nat. size.)

*Ophisurus boro*, Buchan. 20, 363.

(Icon.) *Ophisurus boro*, Gray: Ill. Ind. Zool. I. Pl. 95, Fig. 1.

*Ophisurus boro*, McClelland: Calc. Journ. Nat. Hist. V. 185, 211.

*Ophisurus boro*, Richardson, Report, 1845, 313.

Ground-colour whitish yellow; upper half of head and body, so closely dotted with black, as to produce a general blackish appearance; dorsal pale olive white, dotted and edged with black; anal white; pectorals pale yellowish olive dotted with black; abdomen white. Iris pale golden, dotted with black.

D 315 to 328, A\* 205 to 244, P 13, Br. XXXI.

HABIT.—*Sea of Pinang.*

Estuaries of the Ganges.

TOTAL LENGTH: 2 feet  $2\frac{1}{4}$  inch.

\* These are the greatest variations in individuals examined at Pinang and in Calcutta. Buchanan counts: "A 270?"

The greater part of the body is cylindrical, of nearly equal diameter, but the posterior seventh is gradually compressed and tapering. The length of the head to the gill-opening varies from  $9\frac{1}{2}$  to  $10\frac{1}{2}$  times in the total; it appears constantly to be  $\frac{1}{2}$  of the distance from the muzzle to anus. The latter is situated either at or a little in front of the end of the second-fifth of the total length. The horizontal diameter of the eye is  $\frac{1}{4}$  of the length of the head. The distance from the muzzle to the anterior orbital margin equals two diameters, or the distance between the eyes across the forehead. The distance from the muzzle to the angle of the mouth is contained  $3\frac{1}{2}$  times in the length of the head; the lower jaw is one diameter of the eye shorter than the upper. The nostrils, their lobulets, and the tongue resemble those organs of *O. baccidens*. Beneath the muzzle is a small rounded spot with globular teeth, some of which are larger than the rest, which are continued on an elongated pointed band along the mesial line of the palate. The broadest part of this band contains 4 to 5 series. The teeth of the upper jaw are somewhat smaller than the palatal ones, with which they do not coalesce; the broadest, anterior, portion contains about five series, of which the internal one consists of minute pointed teeth. The bands of the lower jaw have a linear interval over the symphysis, the broadest portion; the teeth resemble those of the upper jaw, but there appear no series of pointed teeth. From between the eyes, on each side of the crown of the head, proceed a series of four distant pores to the muzzle; behind each eye appear three, and there are other series along both jaws and across the occiput. The lateral line resembles in its course that of *O. baccidens*, but the line itself and the pores are more minute. The vertical diameter at the occiput is contained  $3\frac{1}{2}$  times in the head; the greatest one of the body is  $\frac{1}{2}$  of the length of the head; that between the termination of the dorsal and anal is 2 diameters of the eye, and constitutes the base of an equilateral triangle formed by the compressed tip of the tail. The dorsal, which is partly concealed in a deep groove of the back, commences at a little distance behind the apex of the pectorals, the distance from the root of the upper pectoral ray to the first dorsal varies from  $\frac{1}{2}$  of to  $2\frac{1}{2}$  times in the distance from the muzzle to the dorsal. The rays of the dorsal and anal fins are  $\frac{2}{3}$  of the length of the pectorals which measure  $\frac{1}{2}$  of the head.

Single individuals are taken along the coasts of Pinang at irregular intervals.

*B. With pointed teeth.*

*OPHIURUS GRANDOCULIS*, Cantor.

Plate V. Fig. 3, (Magnified.)

Ground-colour of head back and sides yellowish white, minutely and closely vermiculated with brown, and dotted with black, so as to produce a general brownish appearance, lighter on the sides; abdomen white; fins greyish white; minutely dotted with black; dorsal and posterior half of anal edged with black. Iris pale golden, dotted with black.

D 251 to 258, A 152 to 167, P 15, Br. XXXI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 1 foot 6 $\frac{1}{4}$  inch.

The head is elongated with a conical, somewhat bluntly pointed muzzle, the general form of the body resembles that of *O. boreo*. The length of the head to the gill-opening is contained  $11\frac{1}{2}$  to  $11\frac{1}{2}$  times in the total, but  $4\frac{1}{2}$  to  $4\frac{1}{2}$  times in the distance from the muzzle to the anus. The eye is comparatively large, its horizontal diameter varying from  $\frac{1}{11}$  to  $\frac{1}{13}$  of the length of the head; the distance from the muzzle to the eye is two diameters; the eye itself occupies nearly the whole space between the lip and the profile; the distance across the forehead equals one diameter. The distance from the muzzle to the angle of the mouth is contained  $3\frac{1}{2}$  times in the length of the head; the lower jaw is half a diameter of the eye shorter than the upper. The nostrils, lobulets, pores of the head and of the lateral line, as well as the latter itself, resemble those of *O. boreo*. The middle of the tip of the upper jaw has two close series of subulate teeth; in the young each series consists of 3 to 4, but one half of them appear to vanish with age, when those remaining become stronger and blunter. At a short distance behind these commence the double series of teeth of the mesial line of the palate; those of the anterior half are longer than the rest, and become subulate with age; on the posterior half the teeth are much smaller, and placed three deep. The teeth of the jaw commence on each side of those of the mesial line without coalescing with them; they are placed in a single series, are small, pointed or subulate. Those of the lower jaw are also in a single series,



subulate, and they decrease from the symphysis, on which there is a toothless interval between the series of both branches. The tongue is small elongated and tied to the floor of the mouth, of which it occupies the posterior third. The vertical diameter at the occiput is  $\frac{1}{3}$  of, the greatest of the body is contained  $2\frac{1}{2}$  times in the length of the head, while that between the terminations of the dorsal and anal equals the diameter of the eye and forms the base of the triangular tip of the tail, each of the sides of which is two diameters of the eye. The dorsal commences above the posterior third of the pectorals. The distance from the root of the upper pectoral ray to the dorsal is  $4\frac{1}{2}$  to 5 times in that from the muzzle to the dorsal; the general length of the dorsal rays is contained  $5\frac{1}{2}$  times in the head; but immediately before the termination of the fin, the rays suddenly increase in length, and are but  $4\frac{1}{2}$  times in the head. Such is also the case with the anal, which resembles the dorsal. The anus is situated a little in front of the end of the third-fifth of the total length. The pectorals are elongated,  $\frac{1}{3}$  of the length of the head. Single individuals occur at all seasons at Pinang. The present species bears a general resemblance to *O. hijala*,\* Buchanan Hamilton, but in the latter the dorsal commences at a short distance behind the pectorals.

\* Buchan. Ham. pp. 20, 336, Pl. V. Fig. 5. SYN. *O. hyala*, Cuv. R. A. II. 351. (1)—*O. punctulata*, Swainson, II. 334.—*O. rostratus*, McClelland, Calc. Journ. Nat. Hist. V. 184, 211.—*O. hyala*, McClelland, ibid. V. 184, 185.—*O. hijala*, McClelland, ibid. V. 211.—*O. minimus*, McClelland, ibid. V. 185, 212, Pl. X. Fig. 3.—*O. caudatus*, McClelland, ibid. V. 185, 204, Pl. XII. Fig. 3.—*O. rostratus*, Richardson: Report, 1845, 313.—*O. hijala*, Richardson, ibid. 314.—With regard to the nomenclature of Mr. McClelland, it is necessary to observe that the duplicate series of Buchanan Hamilton's drawings contains a figure of this eel, marked in Buchanan's handwriting. "*Ophisuris rostratus*," which is evidently the same as Pl. V. Fig. 5, *O. hijala*, (*Fishes of the Ganges*.) In publishing the figure and the description, Buchanan chose to alter his manuscript name "*rostratus*" to "*hijala*." It is this, by Buchanan himself cancelled manuscript name "*ROSTRATUS*," which Mr. McClelland has introduced as if it were a species distinct from *hijala*, and of which he says: "I have not met with it, but it is closely allied to *Oph. minimus*, from which it only differs in having a square muzzle."—*O. minimus*, McClelland, is characterised as having "the distance from the point of the muzzle to the eyes equal to 1.5 of the distance from the eyes to the pectorals." But in Mr. McClelland's figure (Pl. X. Fig. 3,) the former distance is one-third of the latter, exactly as represented in the outline of *O. hijala*, Buchanan, (Pl. V. Fig. 5.

## OPHIURUS BREVICEPS, Cantor.

Plate V. Fig. 4, (Magnified.)

Head above and back greenish olive, lighter on the sides of the head and body, everywhere minutely dotted with black; throat and abdomen greenish white; dorsal greenish white, dotted and edged with black; pectorals and anal greenish white dotted with brown. Iris pale greenish golden, dotted with black.

D  $\begin{cases} 480, \\ 448, \end{cases}$  A  $\begin{cases} 276, \\ 298, \end{cases}$  P 13, Br. XXXI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 2 ft. 2 $\frac{7}{8}$  inch.

The head is proportionally very short, elongated conical, terminating in a narrow truncated muzzle; the eye small; the body cylindrical, suddenly deepening behind the anus, and slowly tapering towards the small blunt point of the tail. The length of the head is  $\frac{1}{18}$ , or a little less, of the total and contained 5 $\frac{1}{2}$  to 5 $\frac{3}{4}$  times in the distance from the muzzle to the anus. The latter is situated either in the middle of the third-eighth or a little in front of its termination. The horizontal diameter of the small oval eye is contained 13 $\frac{1}{2}$  times in the length of the head; the distance across the forehead is 1 $\frac{1}{2}$  diameter; that from the muzzle to the eye 2 $\frac{1}{2}$  such diameters. The distance from the muzzle to the angle of the mouth is contained 3 $\frac{1}{2}$  times in the length of the head. The upper jaw is a little less than one diameter of the eye longer than the lower. The nostrils and their lobulets, the pores of the head and the lateral line resemble those of *O. boro*. The very minute whitish pores beneath the lateral line are placed at a distance from each other of two diameters of the eye. On the mesial line of the tip of the upper jaw appear two series, each consisting of three small pointed recurvose teeth. At a short distance behind the latter commences the series of the mesial line of the palate;

*Fishes of the Ganges.*)—Of *O. minimus*, McClelland, it is farther said: "the distance from the muzzle to the branchial apertures, is equal to the distance from these to the commencement of the dorsal." In the figure, however, the former distance slightly, yet perceptibly, exceeds the latter, just as it is represented in the figures of *O. Ajab*, Buchanan Hamilton. In *O. caudatus* McClelland, the distance from the base of the pectorals to the dorsal is described as equalling half the distance from the pectorals to the end of the muzzle. In Mr. McClelland's figure, however, the former distance is represented as contained 2 $\frac{3}{4}$  times in the latter.

the anterior teeth are a little stronger than the rest, and placed three deep, then two, and posteriorly in a single series of excessively minute teeth. On each side of the mesial series commences a single one of fine, pointed teeth, which is the internal series of the jaw; behind the posterior aperture of the nostril commences an external series of similar teeth. Those of the lower jaw resemble the latter, but they are throughout placed in a double series, except over the symphysis which is naked. The small elongated tongue is tied to the floor of the mouth; it is placed unusually far forwards and nearly extends to the anterior third of the cavity. The vertical diameter continues uniform from the occiput to the anus, varying in two individuals examined, from  $3\frac{1}{2}$  times in, to  $\frac{1}{4}$  of the length of the head, while their greatest diameters of the two anterior thirds of the tail vary from  $\frac{1}{2}$  to  $\frac{1}{3}$  of the head. The vertical diameter between the termination of the dorsal and anal is but two diameters of the eye, forming the base of the equilateral triangular point of the tail. The small pectorals are from  $\frac{1}{2}$  of, to  $3\frac{1}{2}$  times in the length of the head. The dorsal commences above the apex of the pectorals. Its distance from the root of the upper pectoral ray equals the length of the pectoral fin, and is  $\frac{1}{4}$  of its distance from the muzzle. The length of the dorsal rays is but  $\frac{1}{2}$  of the head. The anal rays are a little longer. Two individuals occurred together at Pinang in November 1844. Although there was a difference of but  $2\frac{1}{2}$  inch in length, the longer was out of proportion, the thicker.

GEN. DALOPHIS, (*Rafinesque*\* 1810.) Swainson, 1839.

No pectoral fins; gill-openings placed very low, towards the sides of the throat; dorsal and anal terminating before they reach the end of the tail, which is naked; body cylindrical, mouth small with minute sharp teeth; nostrils tubular; dorsal fin commencing a little behind the head; vent nearly central; upper jaw much longer than lower.

DALOPHIS ANCEPS, Cantor.

Plate VI. Figs. 1, 2, 3, 4.

Ground-colour of head, back and upper half of sides yellowish white, so sparingly dotted with brown as to acquire a greyish or dusty appearance; beneath the lateral line a pale bluish grey longitudinal band; abdomen white; dorsal and anal hyaline, the lower half of the

\* Swainson: *Classif.* I. 221; II. 335.

former dotted with brown. Iris silvery; orbital margin black; pupil circular, black.

D 251? A 151, Br. XXXI?

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 1 foot, 8 inch.

The head is comparatively short, terminating in a short conical muzzle; the eye very minute; the body is slender, cylindrical, but widens suddenly a little before the termination of the dorsal and anal; the naked tip of the tail is slightly compressed and much blunter than the muzzle. The head, measured to the gill-openings, is  $\frac{1}{15}$  of the total length; it is contained  $10\frac{1}{2}$  times in the distance from the muzzle to the anus, which is situated at the end of the fourth-seventh of the total length. The very minute eye is situated at the commencement of the second-eighth of the head, nearly above the middle of the lip; its distance from the muzzle is a little more than  $\frac{1}{4}$  of the head; the distance between both eyes is a little less. The distance from the muzzle to the angle of the mouth is contained  $4\frac{1}{2}$  times in the length of the head. Between the muzzle and each eye, on the crown of the head, appear three distant pores and five similar on each branch of the lower jaw. The anterior nasal apertures are tubular and open on each side of the point of the muzzle; although very small, each tube is double the length of the diameter of the eye; there are apparently no lobulets; the posterior nasal apertures open through the lower surface of the upper lip, beneath the eyes, as in *Ophiurus*. Beneath the tip of the muzzle appears a double series, each of three very minute pointed teeth. At a short distance behind the latter commences the series of the mesial line of the palate; the anterior part is double, each side consisting of fine teeth which are longer than all the rest, the posterior part is single. The teeth of the upper jaw are minute, distant and placed in a single series, which commences a little behind the anterior teeth of the palatal series. The lower jaw is shorter than the upper; the symphysis is naked; the teeth are minute, pointed and generally in a single series, but near the symphysis appears on each side a short internal series, consisting of three minute teeth. The tongue is very minute, elongated and tied to the floor of the mouth; it does not extend beyond the angle of the mouth. From the occiput to the tail the vertical diameter is contained  $3\frac{1}{2}$  times in the length of the head; the tail slowly increases in depth to a little in

front of the termination of the dorsal and anal, where the vertical diameter suddenly attains its maximum,  $2\frac{1}{2}$  times in the length of the head. Between the termination of the dorsal and anal the vertical diameter is contained  $4\frac{1}{2}$  times in the head, and it forms the base of the bluntly conical tip of the tail, the upper and lower margin of which slightly exceed the base. Owing to the lowness and thickness of the dorsal fin-membrane its precise origin cannot be determined; apparently it commences at a distance from the muzzle of  $\frac{1}{3}$  of the total length, but the rays cannot be distinguished before a little in front of the anterior third of the total. The general length of the rays is  $\frac{1}{2}$  of the head, but it slightly increases above the sudden enlargement of the tail near the termination of the fin. The anal commences at a short distance from the vent and resembles the dorsal. The gill-openings are small, crescent-shaped and placed between the lateral line and the abdominal profile without bordering upon either; the distance from the apparent commencement of the dorsal exceeds by  $\frac{1}{2}$  the length of the head or the distance from the muzzle to the openings. The lateral line commences on the anterior third, but descends at a short distance from the head to the middle of the side and thus continues to the tip of the tail; it consists of a succession of short upwards-arched tubes, apparently without pores.

The species described by Russell (No. XXXVII. *Manti Bukaro Pauwu*), which according to Cuvier is identical with *Cæcula pterygea*, Vahl,\* differs from the present by its much shorter thicker head, and by the anus being situated in the middle of the total length. A solitary individual of *Dalophis anceps* occurred at Pinang, with two of *Ophiurus breviceps*, in November 1844.

GEN. MURÆNA, ([*Artedi*,] Linné, 1766,) Cuvier, 1817.

(GYMNOTHORAX, Bloch-Schneider, 1801.—MURÆNOPHIS, Lacépède, 1803.—LYCODONTIS, McClelland, 1844.—STROPHIDON, McClelland, 1844.—THERODONTIS, McClelland, 1844.)

Pectorals none; branchiæ open on each side by a small hole; opercles thin; branchiostegous rays slender, concealed under the skin;

\* *Skrifter af Naturhistorie Selskabet. Kjöbenhavn*. III. Pl. XIII. 1, 2.—*Sphagebranchus pterygea*, Cav. R. A. II. 353 (2).—*Dalophis orientalis*, McClelland: *Calc. Journ. Nat. Hist.* V. 213.

stomach a short sac; air-vessel small, oval, placed towards the upper part of the abdomen.

**MURÆNA THYRSOIDEA, Richardson.**

Plate V. Fig. 5. (Nat. size.)

*Muraena thyrsoidea*, Richardson: Ichth. Sulph, 111, Pl. 49.

*Muraena thyrsoidea*, Richardson: Report, 1845, 314.

*Muraena grisea*, Bleeker: Verh. Bat. Gen. XXII. 11.?

Head, body and fins of darker or lighter pitch colour, so closely and finely marbled and dotted with white or yellowish white, as not to affect the general dark colour; abdomen lighter than the rest of the body. Iris pale golden, minutely dotted with black.

D }  
C } 569 to 611, Br. IX.  
A }

HABIT.—*Sea of Pinang.*

Canton, China Seas.

TOTAL LENGTH: 2 feet 2 inch.

The form of the body is compressed, of nearly uniform depth. The length of the head to the gill-opening is contained from  $7\frac{1}{2}$  to  $7\frac{3}{4}$  times in the total, or about  $3\frac{1}{2}$  times in the distance from the muzzle to the anus. The horizontal diameter of the eye is  $\frac{1}{10}$  to  $\frac{1}{11}$  of the length of the head; the distance across the forehead is  $1\frac{1}{2}$  diameter; the distance from the muzzle to the eye is two such; that from the muzzle to the angle of the mouth is about  $\frac{1}{2}$  of the length of the head. The anterior apertures of the nostrils open through two small tubes, situated on each side of the muzzle, at a distance from one another of one diameter of the eye. The posterior apertures are small, oval, with a narrow membranous edge; each is placed above the forepart of the orbit. On the upper lip appear on each side four distant pores, and on each side of the lower lip four similar ones. Sir J. Richardson has traced scales before the gill-opening. Both jaws are of nearly equal length and armed with two series of teeth. Those of the outer series are minute, yet strong, pointed with trenchant edges, and the series of both sides are uninterrupted on the symphysis of the upper jaw. Those of the inner series are more distant, thicker and longer. On the mesial line of the upper jaw appear four or five longer, distant, subulate teeth, which gradually increase in length, and are moveable. The rest

of the mesial teeth are minute subulate, headed by one longer than the rest, which are at first placed in a double, but terminate in a single series. Neither tongue nor lateral line are distinguishable. The vertical diameter at the occiput is contained  $2\frac{1}{2}$  times in the length of the head. The anus is situated half the length of the head behind the middle of the total length. The gill-opening is small, oval and placed obliquely, nearer the abdomen than the back. The dorsal commences three diameters of the eye in front of the gill-openings. The rays increase in length towards the posterior half of the tail where they are  $\frac{1}{2}$  of the length of the head. The caudal is but  $\frac{1}{4}$  of the head and so closely attached to the dorsal and anal that its origin cannot be distinguished. The anal commences a little behind the vent: it resembles the dorsal. All the fin rays are double, and hid in the membrane. This species greatly resembles *Muraena tile*,\* (Buchanan Hamilton,) which, however, may be distinguished by a slightly differing dentition, by the vent being situated one or two diameters of the eye before the middle of the total length, and by its colours. Single individuals of *M. thyrsoides* occur at all seasons at Pinang.

**MURÆNA SATHETE, (Buchanan Hamilton.)**

*Muraenophis sathete*, Buchan. Ham. 17, 363.

*Lycodontis longicaudata*, McClelland: Calc. Journ. of Nat. Hist.  
V. 187. Pl. VIII. Fig. 2.

*Strophidon longicaudata*, McClelland: *ibid.* 215.

*Muraena sathete*, Richardson: Voy. Erebus and Terror, 91.

Head, body and fins dark greenish olive, throat and abdomen greenish yellow.

$\left. \begin{array}{l} D+ \\ C \\ A \end{array} \right\} ?$  Br. IX.

\* **SYN.** *Muraenophis tile*, Buchan. Ham. 18, 163. (*Synon. excl.*)—*Lycodontis literata*, McClelland: Calc. Journ. of Nat. Hist. V. 186, Pl. VII. Fig. 2—*Lycodontis punctata*, McClelland, *ibid.* 187, Pl. VII. Fig. 3.—*Strophidon literata*, McClelland, *ibid.* 215.—*Strophidon punctata*, McClelland, *ibid.* 215.—*Strophidon maculata*, McClelland, (*Muraenophis tile baim*, Buchan. MS.) *ibid.* Pl. VIII. Fig. 1.

† Mr. McClelland counts; D 484, A 394, (l. c. 187.)

HABIT.—*Freshwater and Sea of Pinang.*

Gangetic estuaries.

TOTAL LENGTH: 7 feet 8 $\frac{1}{4}$  inch.

The general form of the body is cylindrical to the posterior half of the tail, which is tapering and compressed. The length of the head to the gill-opening is  $\frac{1}{3}$  of the total or about  $\frac{1}{4}$  of the distance from the muzzle to the anus. The horizontal diameter of the eye is  $\frac{1}{3}$  of the length of the head; the distance between the eyes is two diameters: that from the muzzle to the eye  $2\frac{1}{2}$  diameters; to the angle of the mouth it is contained  $3\frac{1}{2}$  times in the length of the head. The apertures of the nostrils resemble those of *M. thyroidea*. The jaws are nearly equal. The teeth of the upper jaw are placed in a single uninterrupted series; they are distant, pointed, with two or three in front of each eye longer than the rest, which are generally small. The teeth of the mesial line commence with a single series of three moveable conical teeth, of which the second is the longest of all; behind it appears a double series of very small conical teeth, which, however, soon coalesce into a single series; opposite the eye commences a single series of palatal teeth which are conical and long. Those of the lower jaw consist of an external series, which is single uninterrupted and formed of small distant conical teeth; on the anterior half of each branch appears an internal distant series composed of four long conical teeth, of which the anterior ones are placed at a little distance behind the symphysis. No tongue is distinguishable. The lateral line is marked by a series of minute white pores which follow the middle of the side to the caudal. The vertical diameter at the occiput is contained  $3\frac{1}{2}$  times in the length of the head; in front of the anus it is  $\frac{1}{2}$  of, but in front of the caudal it is one diameter of the eye. The dorsal originates far in front of the gill-opening, at the commencement of the posterior third of the head: the distance from the muzzle to the dorsal is  $\frac{1}{3}$  of the length of the head, that from the dorsal to the gill-opening  $\frac{1}{4}$ . The dorsal rays are short, and hid by the membrane; their length does not exceed  $\frac{1}{4}$  of the head, of which the caudal is about  $\frac{1}{11}$ . The anus is situated at the end of the fifth-thirteenth of the total length; the fin commences at a short distance behind the vent; the rays are a little shorter than those of the dorsal. A single individual occurred on the



coast of Pinang in May 1845; a second, a little shorter than the former, was taken the following July in fresh water.

GEN. LEPTOCEPHALUS, Gronov. 1754.

Head small and short; teeth numerous; pectoral fins and gill-opening very small; body compressed and very thin, tape-like; dorsal and anal fins small, united at the tail, forming a point.

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A species of this genus was found in the stomach of *Johnius diacanthus*, (Lacépède,) taken at Pinang. The effects of the process of digestion were such as but to admit the following characters to be ascertained. The colour was a semipellucid opal, exhibiting numerous, somewhat distant striæ, or backwards directed angles, above and beneath the lateral line; the iris was bluish silvery, the pupil circular black. The vertical diameter at the occiput slightly exceeded  $\frac{1}{2}$  of the greatest one of the body, which was about  $\frac{1}{18}$  of the total length. The head was small, with a short very pointed muzzle. The profile of the forehead was oblique, meeting the horizontal one of the lower jaw, which nearly equalled the length of the upper; the length of the head was contained  $17\frac{1}{2}$  times in the total; the distance from the muzzle to the posterior circumference of the orbit was  $\frac{1}{2}$  of the length of the head. On each side of the upper jaw appeared five forwards-directed, pointed teeth, and in the intervals between them four smaller, similar ones. Each branch of the lower jaw was armed with five teeth, somewhat longer, but resembling those of the upper jaw; minute teeth appeared in the intervals between the three anterior longer ones. The roots of the pectorals were all that remained, and were placed close to the abdominal profile, immediately behind the gill-opening. The origin of the dorsal and anal fins could not be traced. The total length of the fish was  $4\frac{1}{4}$  inches. From the peculiar dentition the species might be named: *Leptocephalus dentex*. A species of *Leptocephalus* occurs in the Bay of Bengal as far as the Sandheads.\*

\* Mr. McClelland quotes the Gen. *Leptocephalus* as exclusively inhabiting Great Britain. (*Apodal Fishes of Bengal in Calc. Journ. of Nat. Hist. V.*, page 226.)

## FAM. SYMBRANCHOIDÆ.

GEN. SYMBRANCHUS, (Bloch-Schneider, 1801.) Cuvier, 1817.

(UNIBRANCHAPERTURA, Lacépède, 1803.—OPHISTERNON,\*  
McClelland, 1844.)

Differs from *Sphagebranchus*† by the branchiæ communicating outside by a single aperture, pierced under the throat and common to both sides; pectorals none; vertical fins nearly entirely adipose; head thick; muzzle rounded; teeth obtuse; opercles partly cartilaginous; six strong branchiostegous rays; intestinal canal straight; stomach distinguished by its being a little wider, and by a pyloric valve; cœca none; air-vessel long and narrow.‡

SYMBRANCHUS CALIGANS, Cantor.

Plate VII. Figs. 1, 2, 3.

Bálut of the Malays.

(Young?) Head above and back impure lake-coloured with livid

\* "OPHISTERNON:" (Scr. OPHIOSTERNUM.) "A single transverse opening under the throat common to both branchiæ. These consist of four pectinated combs on each side. Two bands of teeth on the edges of the upper jaw, 5 short cartilaginous branchial rays. Eyes small and placed on the muzzle, teeth disposed in bands on the sides of the jaws." (McClelland: Calcutta Journal, Nat. Hist. V. 226.) Of the preceding characters the following are erroneous: "two bands of teeth on the edges of the upper jaw," and "5 short cartilaginous branchial rays." The upper jaw carries but a single band of teeth, and there are six branchiostegous, bony rays on each side. After these errors have been corrected, it is evident that *Ophisternon*, McClelland, is identical with *Symbranchus*. Mr. McClelland himself quotes the definition of *Symbranchus*, Bloch, immediately preceding that of *Ophisternum* (l. c. 175), yet, he observes: "their branchiæ are not described further than that the membrane contains six strong rays." (l. c. 157.) As Cuvier, however, has confined his definition to the differential characters by which *Symbranchus* is distinguishable from *Sphagebranchus*, the simple inference from his silence concerning the branchiæ is, that both genera have the same number (four) on each side.

† SPHAGEBRANCHUS (Bloch-Schneider 1801.) Cuvier, 1817. Differs from *Muraena* principally by the branchial apertures approaching each other under the throat; the vertical fins in several species commence to project near the tail; muzzle extended and pointed; stomach like a long cul-de-sac; intestine straight; air-vessel long, narrow and placed far back.

‡ The Asiatic species, quoted in the following, have no air-vessel.

reflections, lighter on the sides and abdomen ; throat pale livid ; dorsal-, caudal- and anal- membranes pale carmine.

|   |    |           |
|---|----|-----------|
| D | 0  | } Br. VI. |
| C | 10 |           |
| A | 0  |           |

HABIT.—*Sea of Pinang.*

TOTAL LENGTH :  $8\frac{1}{2}$  inch.

The head is conical, depressed, with rounded muzzle, swelling towards the occiput ; the body is cylindrical with the sides slightly compressed, of nearly equal diameter ; the short, tapering tail is greatly compressed like a two-edged sword. The length of the head, from the muzzle to the gill-opening, is contained  $8\frac{1}{2}$  to  $8\frac{3}{4}$  times in the total. The eye, a minute black speck, is situated nearly opposite the middle of the lip ; its distance from the muzzle is  $\frac{1}{4}$  of the length of the head. That from the muzzle to the angle of the mouth is  $\frac{1}{3}$  of the length of the head. The minute anterior nasal apertures are situated on each side of the muzzle ; their margins are raised, not tubular. The larger, posterior apertures are situated obliquely above the eyes ; they are of a lanceolate form, with the broader part in front of and on a higher level than the eye, and with the apex extending downwards and outwards to the supraorbital margin. The lips are membranous, the under one reverted over the lower jaw, which is very little shorter than the upper. The teeth are all blunt and minute, yet there is a perceptible difference in their length. Each branch of the upper jaw carries a series of excessively fine, almost setaceous teeth, which under the symphysis become crowded and form a small triangular figure. The base of both triangles is bordered by three teeth larger than the rest, and separated by a naked longitudinal interval. The palatal teeth are longer than the preceding, and are placed in a single close series, uninterrupted on the vomer. The teeth of the lower jaw are a little stronger than the palatal, and appear truncated ; both branches carry a single series ; both coalesce on the symphysis where they expand in a semilunar band, three or four teeth deep. The fleshy tongue is elongated, conical, with rounded apex, extending to the symphysis ; it is moveable by means of a lax frænulum. The margins are thickened, rounded, forming a longitudinal groove along the upper surface of the tongue. Between the upper extremity of the hyoid bone and that of the anterior branchial

arch appears a small blind fossa, without sac, like that discovered by M. Johannes Müller in another Indian species : *Symbranchus immaculatus*, Bloch. (J. Müller : *Myxinoiden in Abhandl. der Königl. Akad. der Wissensch. zu Berlin*. 1839. Berlin, 1841, p. 245.) On each side of the pharynx is a small oval fleshy tubercle, behind which a second one studded with minute card-like teeth, and immediately behind the middle of the posterior branchial arch appear a few similar teeth, forming a short linear group accompanying the arch. The lax undivided gill-membrane is externally marked by some longitudinal furrows; the posterior margin is backwards arched and extends to the upper third of the side, the origin of the lateral line. The bony branchiostegous rays are short, but strong, compressed and of equal length; the four upper ones are separated by a short interval from the two lower, which are also placed farther from each other than the preceding. Of the four densely fringed branchiæ the posterior is the shortest, and closely connected to the third branchial arch by a membrane with a small oval aperture in the middle. The lateral line is a groove commencing at the angle of the gill-opening, and continuing a little nearer the back than the abdomen towards the anus; it proceeds along the middle of the side of the tail to the caudal. The greatest vertical diameter, at the occiput, is contained  $3\frac{1}{2}$  times in the length of the head; at the anus  $4\frac{1}{2}$ . The length of the tail varies from about  $\frac{1}{4}$  to  $\frac{1}{3}$  of the total. The skin is naked and lubricated by mucus. The membranous dorsal commences opposite the anus, but is not distinct on the anterior third of the tail. The anal resembles the dorsal; the height of either scarcely exceeds  $\frac{1}{4}$  of the vertical diameter at the anus. Both unite with the short pointed caudal, which contains ten minute, jointed, simple rays. A solitary, apparently young, individual occurred at Pinang in September 1843; a second,  $6\frac{1}{2}$  inch in length, in February 1845.

The distance from the gill-opening to the heart slightly exceeds the length of the head. The digestive canal is a little less than  $\frac{1}{4}$  of the total length. The œsophagus and stomach form an elongated cylinder, which gradually widens towards the pylorus, which is internally marked by a valve. The duodenum, which is narrower than the fundus of the stomach is situated in the middle of the digestive canal. The intestines form a simple cylinder, widening towards the rectum, without cæcopyloric appendages or circumvolutions. The liver consists of a

very elongated single lobe with many transversal incisions; it commences from the bulbus arteriosus, and gradually widening extends to a short distance from anus; the colour is pale reddish brown. The gall-bladder is small, oval, of a pale bluish green; it is attached to the liver at a short distance in front of the pylorus, or nearly halfway between the muzzle and the anus. The spleen is elongated oval, smaller than the gall, and situated closely behind the pylorus. There is no air-vessel.

*Symbranchus caligans* differs from *S. gutturalis*, Richardson, (*Ichthyol. Erebus and Terror*, 49, Pl. XXX, Figs. 14—17.) from Dampier's Archipelago, by its proportionally longer head, and shorter tail: in the latter species the head is  $\frac{1}{11}$  of, the tail less than  $\frac{1}{3}$  of the total length, and there are 7 caudal rays.

From *Symbranchus immaculatus*, Bloch\* the present also differs by a proportionally longer head, and shorter tail. Of a number of *S. immaculatus* examined, the majority had 5 caudal rays, few 3, 6 or 7.

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\* Bloch. XII. 77, Tab. 419, Fig. 1. (*Excl. Habit. Surinam.*) SYN: *Symbranchus immaculatus*, Shaw, IV. 36.—*Symbranchus immaculatus*, Cuvier, R. A. II. 354(\*).—*Symbranchus immaculatus*, Müller, Myxinoid. in Abh. der Königl. Akad. Berlin, 1839, 245.—*Ophisternon bengalensis*, McClelland: Calc. Journ. Nat. Hist. V. 197 and 220, Pl. XI. Fig. 1-2.—M. Johannes Müller, l. c. points out the error committed by Bloch, who considered *S. immaculatus*, which he received from Tranquebar, to be identical with another distinct species inhabiting Surinam. To avoid confusion, a specific name requires to be given to the Brazilian species. *S. immaculatus* is numerous in the Hooghly, and appears daily in the Fish Bezaars of Calcutta. Individuals exceeding 14 inches in length, are rarely seen, but they are said to attain to two feet. The description of this species given by Mr. McClelland under the name of *Ophisternon bengalensis* is defective and disfigured by the following errors. The eyes are represented as being "placed before and external to the posterior apertures of the nostril;" the branchial rays are said to be five and to be cartilaginous, and the maxillary teeth are described and figured as "forming a crescent in front under the apex of the jaw."

The posterior apertures of the nostrils are pierced vertically between, not behind the eyes; a tangent of the posterior margin of the aperture continued downwards, touches the posterior orbital margin; but a tangent of the anterior margin of the aperture, if prolonged vertically, divides the eye. There are six, bony, branchiostegous rays, and the maxillary teeth of both branches do not coalesce in a crescent beneath the symphysis, but are separated, and terminate in two small triangles as described in *S. caligans*. In a number of individuals of *Symbranchus immacula-*

In *Ophisternon hepaticus*, McClelland, (Calc. Journ. Nat. Hist. 198 and 221, Tab. XI. Fig. 3-4) the eyes are said to be placed "a little before the posterior openings of the nostrils." Both description and figures are too defective to identify the species.

GEN. MONOPTERUS, ([Commerson] Lacépède, 1800,) Cuvier, 1829.

(OPHICARDIA, McClelland, 1844.)\*

With the two branchial apertures united under the throat in a transverse fissure, divided in the middle by a partition; dorsal and anal only visible in the middle of the tail and uniting at its point; teeth like those of a card in the jaws and palatals; branchiostegous rays six; branchiæ three.

the length of the head varied from  $9\frac{1}{2}$  times in, to  $\frac{1}{12}$  of the total, and that of the tail from  $3\frac{1}{2}$  to  $3\frac{1}{4}$ . As observed by M. Johannes Müller, this species has several anatomical characters resembling those of *Amphipnous cuchia*, (Buchan. Hamilton). SYN. *Dondoo Paum*, Russell: XXXV.—*Unibranchapertura cuchia*, Buchan. Ham. 16, 368, Pl. XVI. Fig. 4. (Synon. *exclus.*)—*Synbranchus cuchia*, Cuv. R. A. II. 354 (2). (Synon. *exclus.*)—*Cuchia*, Taylor, in *Gleanings in Science*, II. 173.—*Synbranchus cashia*, Swainson, II. 336.—*Ophichthys punctatus*, Swainson, *ibid.*—*Amphipnous cuchia*, Müller: Archiv. 15, 1840.—*Amphipnous cuchia*, J. Müller: Myxinoiden in Abh. Berl. Akad. 1839, 244, (Berlin, 1841).—*Cuchia*, McClelland, Calc. Journ. Nat. Hist. IV. 411.—*Pneumabranchnus striatus*, McClelland: Calc. Journ. Nat. Hist. V. 192 and 219, Pl. XIII.—*Pneumabranchnus leprosus*, McClelland, *ibid.* 195 and 219.—*Pneumabranchnus albinus*, McClelland, *ibid.* 196 and 219.

*Dondoo Paum*, Russell, XXXV, has been identified by the examination of a specimen in the collection of Mr. Walter Elliot, who obtained it from the Ankapilly Lake. The discovery of the lung-like sacs of this eel belongs to James Taylor, Esq. late Civil Surgeon of Dacca, and has been acknowledged by Mr. Johannes Müller. Although the treatise entitled: "*Apodal Fishes of Bengal*," has added nothing new to our knowledge of the anatomy and habits of the fish, no reference is made in it to Mr. Taylor's original communication in '*Gleanings in Science*,' (l. c.) Russell discovered *Amphipnous cuchia* in the Ankapilly Lake; Buchanan Hamilton observed the fish in rivers and ponds of the South East parts of Bengal, and Mr. W. Griffith in Assam. In December 1848 an individual was taken in the Chanaub near our camp at Ramnuggur, and in February 1849 another was taken in the Jehlum not far from our Camp at Chillianwalla. (Punjaub.)

\* "OPHICARDIA: (SER. OPHICARDIA)." Two broad bands of teeth on the upper and one on the lower jaw; a single transverse opening under the throat, diverging on either side to the gills, which consist of three slightly pectinate fleshy

## MONOPTERUS JAVANICUS, Lacépède.

Plate V. Figs. 6, 7, 8. (Nat. size.)

Monoptère javanais, Lacép. II. 139.

Unibranchaperture lisse, Lacép. V. 658, Pl. 17, Fig. 3.

Monopterus javanicus, Shaw, IV. 39.

Monoptère javanais, Cuvier, R. A. II. 354.

Monopterus javanensis, Swainson, II. 336.

Ophicardia phayriana, McClelland: Calc. Journ. of Nat. Hist. V.  
191, 218, Pl. XII. Fig. 1.

Monopterus lævis, Richardson: Voy. Sulph. Ichth. 116.\*

Monopterus cinereus, Richardson: *ibid.* 117, Pl. 52, Fig. 1-6.  
(*Synon exclus.*)Monopterus? (Symbranchus?) xanthognathus, Richardson, *ibid.*  
118, Pl. 52, Fig. 7?

Monopterus lævis, Richardson, Report, 1845, 315.

Monopterus cinereus, Richardson, *ibid.* 315.Ophicardia xanthognatha, Richardson, *ibid.* 116?

Bálut of the Malays.

(*Young.*) Head above, back and sides above the lateral line blackish brown with bluish reflections; rest of the sides, throat and abdomen pale brownish blue; fin-membranes blackish. Iris pale golden, dotted with brown; pupil circular black.

TOTAL LENGTH:  $4\frac{1}{2}$  to  $6\frac{1}{2}$  inch.

(*Adult.*) Ground colour of head above, cheeks, back and sides above the lateral line reddish yellow ochre, or pale greenish yellow; rest of the sides, throat and abdomen pale yellow ochre or buff; head back and sides so densely spotted with blackish brown, as to leave but

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combs; no scales, five rays in each side of the branchial membrane. There is but one species known and this has no air-vessel." (McClelland: *Calc. Journ. Nat. Hist.* V. 175.) The characters by which *Ophicardia* is supposed to differ from *Monopterus* are the assigned single transverse opening under the throat, and the five branchiostegous rays:—both characters, however, happen to be erroneous, as "*Ophicardia phayriana*," like a *Monopterus*, has two branchial apertures and six branchiostegous rays.

\* Sir John Richardson has identified this fish with *Unibranchaperture lisse*, Lacép.

little of the ground-colour to view like single small spots; cheeks, throat and abdomen with paler and fewer brown spots; abdomen in some individuals not spotted; lateral line of the ground-colour of the body. Iris light brown, with a narrow golden ring enclosing the pupil.\*

TOTAL LENGTH: 10 $\frac{1}{4}$  to 20 $\frac{1}{4}$  inch.

{ D 0,  
C 2, 3, 4 or 5, Br. VI.  
A 0,

HABIT.—*Sea of Pinang, Malayan Peninsula.*

Arracan coast, Sunda isles, China Seas, (Hong-Kong, Car-  
ton, Chusan, Woosung.)

The general form of the fish is cylindrical, gradually tapering from the occiput, where the diameter is greatest, to the tail which is greatly compressed, like a two-edged sword, and tapers more suddenly than the body, terminating in a sharp point. The head is conical, swelling towards the occiput, the profile of which is more or less arched. Between the eyes the head is somewhat depressed, and the profile slopes towards the rounded depressed muzzle, which slightly projects beyond the rounded narrower apex of the lower jaw. Both individually and according to its age this species presents considerable variations in its external characters. The following have been found constant in a number of individuals of different size. The body is viscous and without scales. The eye is situated above the middle of the upper lip, almost bordering upon the profile; the form of the eye is oval, and it is obliquely placed, with the greatest diameter diverging backwards and downwards. The distance between the posterior margins of the eye is therefore greater than that between the anterior margins; the distances from the

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\* Specimens preserved in spirits of wine change the colours, and appear as described by Sir John Richardson. *Monopterus lavis*, "Corpore caryophyllaceo-brunneo immaculato, subtus pallidiori; genis punctatis."—*Monopterus cinereus*. "The colour of the fish generally is lead-grey, paler beneath, and thickly speckled on the back and sides with small points of hair brown. There are some pale streaks on the top of the head." (*Voy. Sulph. Ichth.* pp. 116, 117.) The drawing from which *Monopterus sankhognathus* was taken, has evidently been coloured from a living or fresh fish.



eye to the muzzle, and that to the angle of the lips are nearly equal. The anterior nasal apertures are very minute, with a slightly raised margin, but not tubular, and situated on each side of the muzzle; the posterior ones open on the crown of the head; although small, they are conspicuously larger than the anterior; they are pyriform with the apex close to the centre of the supraorbital margin, and they are directed obliquely inwards, so that the distance between their fundus, which is a little beyond the anterior orbital margin, is less than that between the apex of both. The narrow lips are membranous, the upper one slightly, the lower very reflex; their commissure is situated considerably less than half the distance between the muzzle and the gill-opening. The teeth are villiform, somewhat varying in length; under a lens they appear conical, slightly recurved, with a blunt apex. Those of the upper jaw form a narrow band, tapering towards the angle of the mouth; at the symphysis the band of each limb forms a short linear process, separated by a linear naked interval. The palatal band resembles the maxillary, but both branches coalesce on the vomer at an acute angle, and internally and externally the band is enclosed by a papillary fold of the membrane lining the palate, which gives the band the appearance of being broader than it really is. On each side of the pharynx, between the root of the posterior free gillarch and the fourth appears a small rounded tubercle, studded with minute card-like teeth. Immediately behind the middle of the fourth, posterior arch, appears a short linear group of similar teeth. The teeth of the lower jaw resemble the rest; the bands of both branches taper towards the angle of the mouth; on the symphysis they either coalesce or are separated by a linear interval. Also this band is internally lined by a papillular duplicature of the membrane of that part of the mouth. The fleshy moveable tongue is elongated, tapering into a narrow flattened and rounded apex. The upper surface is papillular, like the roof of the mouth; the anterior half is flattened and thin, the posterior is thick, hollowed into a longitudinal channel between the two rounded margins, which Lacépède from the MS. of Commerson describes as two tubercles at the base of the tongue.

Between the root of the upper extremity of the hyoid bone and the anterior gillarch, but nearer the former, appears a small blind fossa, apparently without sac, like that of *Symbranchus*. The oblique gill-openings

are almost confined to the abdominal surface, meeting at an acute angle on the throat; they are divided by a thin longitudinal septum, which does not, however, extend as far back as the angle of the gill-openings, and they consequently have the appearance of being single as in the Gen. *Symbranchus*. A fold, corresponding to the septum, appears on the external surface of the membrane. In the posterior half of each cavity appear three small, but slightly curved bony arches, with minute branchiae. The fourth, posterior, arch is entirely hidden by the integuments. The branchiostegous rays are generally short, but unequal: the four upper ones are placed closely together, the two lower ones at some distance below the former; the second upper ray and the two lower ones are of nearly equal length, about double that of the remaining three. A linear groove marks the lateral line, which continues nearly in the middle of the side to the point of the tail. In specimens preserved in spirits of wine the contraction of the muscles produces another linear groove dividing the space between the back and the lateral line. All the preceding characters correspond to those of *Monoptère javanais*, Lacépède. The following are the characters which vary, not only according to age, but even in individuals of equal dimensions. The length of the head (measured from the snout to the hinder angles of the gill-openings,) varies from  $\frac{1}{12}$  of, to  $15\frac{1}{2}$  times in the total; the tail from  $\frac{1}{4}$  of to  $2\frac{3}{4}$  in the total length. Generally the head is proportionally shorter in the young, but the tail longer than in the adult. The distance between the eyes, across the forehead, is anteriorly about three-, posteriorly about four diameters of the eye. On the top of the head, on the upper lip and the throat appear some minute distant pores, the number of which varies individually. Of the three united fins the two are entirely membranous; the very small caudal encloses from two to five undivided rays, so very minute, that a lens is required to observe them through the semitransparent membrane. In adult individuals they are frequently not distinguishable. The dorsal commences a little behind the root of the tail, rising into a low arch above the middle of the tail and then gradually decreasing towards the caudal. The anal may be traced from the anus in the form of a raised line, sunk in a groove; on the posterior two thirds of the tail it forms a skinny hem, less elevated than the dorsal. Both are frequently very indistinct in individuals of all ages, and can then barely be distinguished

by their semitransparency. Single individuals occur on the coasts of Pinang at all seasons.

The constant characters occur in *Monopterus laevis*, Richardson, and in *M. cinereus*, Richardson; of the inconstant characters some are applicable to either.—*Ophiocardia phayriana*, McClelland, is described as having two short tubular nostrils at the extremity of the muzzle, and five branchiostegous rays. Both characters are erroneous, and the fish nowise differs from *M. javanicus*.—*Monopterus grammicus*, (Cantor,)\* observed at Chusan and in Japan, presents the following differences. The head is contained about  $10\frac{1}{2}$  times in the total length, the tail from  $4\frac{1}{2}$  to 5, and in a Japanese specimen it was about 7 times in the total. The head is consequently proportionally longer, and the tail shorter than in *M. javanicus*. The living individuals examined in 1840 at Chusan had the head, back and sides above the lateral line of a reddish yellow ground-colour; the rest of a dark buff; the whole body covered with numerous black irregular lines, like inscriptions, leaving but little of the yellow and buff to view. In other external, and in anatomical characters they agreed with *M. javanicus*, and it remains to be ascertained if the above mentioned differences are constant, specific, or merely individual. The original of *M. xanthognathus*, Richardson† is either *M. javanicus*, or *M. grammicus*, if the latter is a distinct species.

In *Monopterus javanicus* the heart is situated at a distance behind the gill-openings of about  $1\frac{1}{2}$  times the length of the head. The digestive canal is about  $\frac{2}{3}$  of the total length. The œsophagus and stomach form a long canal, which gradually widens towards the pylorus, and is about  $\frac{1}{2}$  of the digestive canal; on the internal surface appear some longitudinal rugæ, which terminate at a short distance from the pylorus. The origin of the duodenum is internally marked by a very distinct valve, and externally by a considerable constriction. The

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\* SYN. *Symbranchus grammicus*, Cantor: Ann. and Mag. of Nat. Hist. IX. 30.—*Monopterus marmoratus*, Temminck et Schlegel: Fauna Japon.—*Monopterus marmoratus*, Richardson: Report, 1845, 315. This eel is numerous at Chusan in streamlets, canals and estuaries. As it is a favourite article of food, it is kept by the inhabitants of Chusan in large jars with fresh water. But it is capable of living a considerable time out of water. It is of voracious habits, feeding on smaller fishes, and it takes hooks baited with earth-worms.

† Voyage of H. M. S. Sulphur, Ichthyology: 118, Pl. 52, Fig. 7.

coats of the stomach are perceptibly thicker than those of the intestines, which form a narrow cylinder without cœcopyloric appendages or circumvolutions, and widen a little towards the anus. The liver is linear, consisting of a single lobe, but subdivided by numerous small transverse incisions; it accompanies the stomach and terminates a little behind the pylorus.

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## ORDO PLECTOGNATHI.

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### FAM. BALISTISIDÆ.

GEN. BALISTES, ([*Artedi*] *Linné*, 1748) *Cuvier*, 1817.

Body compressed; in each jaw a single series of eight, generally trenchant, teeth; skin scaly or granulated, but not exactly osseous; anterior dorsal composed of one or more spines, articulated with a peculiar bone, fixed to the skull and furrowed to receive the spines; posterior dorsal soft, long, opposite to a nearly similar anal; ventrals none, but a pelvic bone suspended to those of the shoulder.

#### BALISTES CONSPICILLUM, Bloch-Schneider.

Renard : I. 15, Fig. 88.

Baliste américain, Lacépède, I. 377, Pl. 16. Fig. 2.

Balistes conspicillum, Bloch-Schneider, 474.

Balistes bicolor, Shaw, V. 407, Pl. 168.

Lesson et Garnot : Voy. de la Coquille, Pl. 9.

Quoy et Gaimard : Uranie, Pl. — Fig. 1.

Balistes conspicillum, Cuv. R. A. II. 373, note.

Rhinacanthus conspicillum, Swainson, II. 325.

Balistes conspicillum, Richardson : Report, 1845, 201.

Balistes conspicillum, Temm. et Schl. Fauna Japon. Pisces, Tab. CXXIX. Fig. 1. (*Adult.*)

(*Young, from 1 to 3 inch. in length.*) Head above, back and upper half of the sides pale rust-coloured or reddish brown, with more or less distinct snuff-coloured, short, longitudinally undulating lines or spots; lower half of sides, throat and abdomen impure brownish white with pale brown patches; in some on the sides of the head and body a few

distant white dots; fins brownish white; second dorsal, caudal and anal with large brownish grey or black patches. Iris pale frosted silvery minutely dotted with brown; in some with three or four indistinct radiating brown bars; orbital margin blackish.

(From 3 to 6 inch. in length.) Yellowish-, reddish- or blackish-brown, back darker, abdomen lighter than the rest; sides, throat and abdomen in some individuals with more or less distinct rounded whitish spots\*; and in others an indistinct whitish forwards arched band from eye to eye; pectorals transparent brownish grey with a blackish spot at the root; rest of the fins brownish black, darker than the body; the basal half of their membranes in some individuals with very indistinct whitish spots. Iris pale silvery round the pupil; rest black.

D 3—23, 24 or 25, G 10½, A 20, 21 or 22, P 14 or 15, Br. VI.

HABIT.—*Sea of Malayan Peninsula and Islands.*

Japan, China Sea, Natunas, Indian Ocean, Mauritius,  
Madagascar.

TOTAL LENGTH: 6 inch.

When the pelvic spine is withdrawn the general outline of the body is oval. The length of the head, from the muzzle to the upper part of the gill-opening, is contained  $3\frac{1}{2}$  times in the total length. The anterior angle of the orbit is situated close to the profile above the centre of the length of the head,\* of which the horizontal diameter is  $\frac{1}{2}$ ; the distance across the slightly arched forehead is a little less than two diameters. Each nostril has two small tubular apertures situated a little in front of the anterior angle of the orbit; the anterior aperture is directed forwards, the posterior backwards. The mouth is small with fleshy lips. In each jaw appear eight obliquely truncated, trenchant teeth, gradually increasing in size towards the symphysis. In the teeth of the upper jaw the internal surface is larger than the external, elongated oval, flattened with a rounded impression at the anterior part. In young individuals the internal surface is finely transversely furrowed, but with age it becomes smooth. The internal surface of the teeth of the lower jaw is almost entirely hid by a small crescent-shaped

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\* In one individual, taken off the Natunas Isles, (4° N. L. 108° E. in the southern part of the China Sea,) the body was said to be covered with blood red spots; after having been preserved in spirits of wine, it appeared of a uniformly blackish brown.

membrane. The tongue is small, rounded, fleshy and tied to the floor of the mouth. The anterior dorsal commences a little behind the anterior third of the back, the caudal not included; the first spine is very thick, with the anterior rounded margin prickly; the sides are smooth, longitudinally striated; the length is less than  $\frac{1}{2}$  of the head; but in very young individuals it is proportionally a little longer. The second spine, which at the root is in contact with the former, is much slenderer, smooth, and but  $\frac{2}{3}$  of the anterior; it is easily laid down, and when it reclines, the anterior trigger-like spine spontaneously follows. The third, slender spine is placed at a distance from the second of twice its own length, which is  $\frac{1}{2}$  of that of the former; it may be reclined either forwards or backwards in the groove of the back. All three spines are connected by a lax membrane. The distance from the first to the third spine equals the length of the former, and also the distance from the third spine to the posterior dorsal fin. The latter is nearly equilateral triangular. The anterior four rays, of which the first and second are undivided, rapidly increase in length; the fifth and sixth are the longest, by  $\frac{1}{3}$  longer than the first dorsal spine; the succeeding rays gradually decrease; the last, which is undivided, equals the third spine. The sides of all the rays of this and the remaining fins are covered with minute spines. The extent of the base of the second dorsal equals the distance of this fin from the first dorsal spine. Its distance from the caudal equals that from the third spine. The caudal is broad with the posterior margin convex; the length is a little less than the longest dorsal rays. The anus is situated opposite the first dorsal ray; the anal fin commences opposite the fourth; the extent of the base is a little shorter than that of the posterior dorsal; in other respects the two are equal and terminate opposite each other. The length of the rounded pectorals is a little more than  $\frac{1}{2}$  of the head. The pelvic spine protrudes but very little, and is but slightly protractile; externally its length equals that of the longest dorsal rays; the triangular dewlap has the anterior and posterior margins equal, but the base, from the root of the pelvic spine to the anus, exceeds by  $\frac{1}{3}$  the two margins. The vertical diameter of the occiput equals the length of the head; that in front of the posterior dorsal is contained  $2\frac{1}{2}$  times in the total length; when the pelvic spine is protracted the greatest vertical diameter is  $\frac{1}{2}$  of the total length. The body is covered with rhomboidal prickly scales. At

a little distance beneath the back and behind the pectorals, each scale is provided with a central, backwards arched, small but strong spine; forming longitudinal series, of which upwards of 20 may be counted between the posterior dorsal and the anal, 10 on the tail. At the lower part of the dewlap these spines appear in clusters of from three to five.

The stomach is capacious, elongated; it contained remains of fish; (in several, of *Exocoetus nigripennis*, Cuv. and Val.) The intestinal canal is wide, contained about  $1\frac{1}{2}$  times in the total length. The liver is large; the right lobe consists of two elongated portions; the left is broader and deeply cleft. The gall-bladder is large, ovoid, expanded with a whitish green fluid; the spleen is small. The silvery air-vessel is elongated oval, occupying the upper part of the abdominal cavity. At Pinang and Singapore this species is numerous at all seasons.

GEN. MONACANTHUS, Cuvier, 1817.

Scales small, covered with stiff asperities, close like velvet; extremity of the pelvis salient and spinous; anterior dorsal fin with a large prickly spine, and a second almost imperceptible.

MONACANTHUS TOMENTOSUS, (Linné.)

Seba: III. Tab. XXIV. Fig. 18.

Gronov. Mus. Tab. VI. Fig. 5.

Balistes tomentosus, Linné: Syst. 1463.\*

Balistes tomentosus, Shaw, V. 401, Pl. 169.

Monacanthus tomentosus, Cuvier, R. A. II. 373 (\*)

(Young.) Yellow; dewlap washed with grey; except the throat and dewlap, the rest of the body with numerous small rounded cobalt blue spots; first dorsal spine yellow with three blackish rings, membrane bluish white minutely dotted with brown; posterior dorsal, anal and pectorals yellowish, transparent; caudal rays whitish, membrane black. Iris pale golden, orbital margin blackish.

D 2—31, C  $10\frac{1}{2}$ , A 28, P 12, Br. VI.

HABIT.—Sea of Pinang.

Indian Ocean.

TOTAL LENGTH:  $3\frac{1}{4}$  inch.

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\* Distinct from *Balistes tomentosus*, Bloch, Pl. 148, which Cuvier refers to *Pisces*, Marcgr. 154. Mr. Swainson quotes the species of Bloch, (Sw. II. 327.)

When the pelvic spine is withdrawn, the outline of the body is elongated oval. The length of the head, from the muzzle to a little behind the orbit, is contained  $3\frac{1}{2}$  times in the total. The eye is situated at a little distance beneath the first dorsal spine, and above the pectorals and gill-openings; the horizontal diameter is  $\frac{1}{4}$  of the length of the head and equals the distance between the eyes. The nostrils, lips, teeth and tongue resemble those organs of *Balistes conspicillum*. The first dorsal spine rises above the eye; it is moderately strong, slightly arched and serrated both on the anterior and posterior margin; it is a little less than  $\frac{1}{4}$  of the length of the head; the second spine is very slender, like a bristle and flexible,  $\frac{1}{4}$  of the length of the former. Their connecting membrane extends but little behind the orbit; its distance from the posterior dorsal equals the length of the first spine. The first four rays of the posterior dorsal gradually increase in length; the fifth ray, from which the rest very slowly decrease, is but little longer than the horizontal diameter of the eye; the extent of the base is  $\frac{1}{4}$  of the length of the head; the distance from the caudal is  $\frac{1}{3}$  of the extent of the base. All the rays of the posterior dorsal, the anal and the pectorals are undivided and spinous on their sides. The caudal is elongated, with the posterior margin rounded; all the rays except the upper and lower, are divided; the length of the central ones is  $\frac{1}{4}$  of the head. Although the anal commences a little in front of the posterior dorsal, the extent of its base is not longer; in other respects it resembles the dorsal. The pectorals are rounded,  $\frac{1}{4}$  of the length of the head. The point of the pelvic spine barely projects beyond the integuments; the spine is large, arched;  $\frac{2}{3}$  of the length of the head; it is very protractile, forming the anterior margin of the triangular dewlap; the base of the latter equals this margin; but the posterior margin is shorter by  $\frac{1}{4}$ . The vertical diameter of the protracted dewlap is contained  $2\frac{1}{2}$  times in the total; in front of the posterior dorsal it is  $\frac{1}{4}$  of the total. The whole body has a downy appearance from being covered with minute prickles, rough to the touch; those of the tail are a little longer than the rest. A solitary individual occurred at Pinang in July, 1844.

MONACANTHUS GEOGRAPHICUS, (Péron.)

*Balistes geographicus*, Péron.

*Monacanthus geographicus*, Cuv. R. A. II. 373 ('), Pl. XI. Fig. 2.  
(Young.)



*Monacanthus geographicus*, Swainson, II. 327.

Ground-colour pale greenish blue with scattered small brown spots; from the anterior part of the base of the posterior dorsal to behind the eye an oblique, undulating, lilac brownish band, edged with whitish, and with numerous small brown spots; a second similar from the middle of the base of the posterior dorsal to beneath the pectorals; a third from the posterior part of the latter fin and the tail to the anus; these bands are frequently interrupted or broken up, so as to make the body resemble a geographical chart of islands; from the anterior part of the orbit three or four short radiating brownish bands; first dorsal spine greenish blue, indistinctly annulated with brown; membrane pale lilac clouded and minutely dotted with brown; rays of posterior dorsal, caudal and anal pale greenish blue; their membranes pale brownish lilac transparent; basal half of dorsal with three or four parallel undulating brown lines; anal with a dark brown net-work; anterior two thirds of caudal with numerous brown dotted lines, parallel to the posterior margin, near which 6 or 7 pale blackish lilac confluent lines; lower part of the dewlap pale whitish lilac with small brown spots, Iris frosted silvery, with indistinct radiating brownish bars.

D 2—29, 31 or 32, C 10½, A 29, 30, 31 or 32, P 13 or 12, Br. V.

HABIT.—*Sea of Pinang, Singapore, Malayan Peninsula.*

TOTAL LENGTH: 8½ inch.

When the pelvic spine is withdrawn, the form of the body is nearly rhombic. The length of the head, from the muzzle to a little behind the orbit is contained 3½ times in the total. The eye is situated at a short distance beneath the first dorsal spine; the posterior margin of the orbit is immediately above the gill-opening; the horizontal diameter of the eye is contained 4½ times in the length of the head. The outline of the forehead is concave, ascending towards the first dorsal spine; angular from side to side; the horizontal distance between the eyes equals one diameter. The nostrils, lips, teeth and tongue resemble those organs of *Balistes conspicillum*. The four upper branchiostegous rays are slender like hairs, the fifth is broad, sabre-like, with the upper margin elongated; it appears like two soldered together; the first dorsal spine is strong and a little backwards arched; the anterior surface is rounded, longitudinally furrowed and very prickly; the posterior is smooth, with about 7 strong downwards directed thorns on each side; the length of the spine equals

the distance from the muzzle to the eye. The membrane is very short and completely envelops the minute slender second spine. The furrow of the back is very short and not intended to receive the first spine, which can but partially be laid down, so as not to touch the back, by reclining the second. The distance from the first spine to the posterior dorsal fin is undulating, gradually ascending, and equals the distance from the muzzle to the first spine. All the rays of the posterior dorsal are undivided, with minute spines; the first is but little shorter than the second and third, the longest, which are  $\frac{2}{3}$  of the first dorsal spine. The succeeding rays gradually decrease; the base is very sloping; its extent equals the distance from the first dorsal spine. The distance from the caudal is  $\frac{1}{3}$  of the base. The anal fin is placed opposite to the posterior dorsal which it resembles. The caudal is broad rounded; in individuals from 5 inches in length and more, the upper, undivided ray, and the adjoining half of the second, divided one, project beyond the others, and form a kind of short filament. The length of the central rays are in young individuals  $\frac{1}{2}$ , in older  $4\frac{1}{2}$ , in the total. The pectorals are rounded,  $\frac{1}{3}$  of the length of the head. The pelvic spine is strong, nearly  $\frac{1}{4}$  of the total length, and very protractile. Near the scarcely projecting apex is a deep naked incision in the anterior margin, with five strong upwards directed thorns. At the incision there is no joint in the spine, but there is one a little lower down, so that the thorny apex of the spine is freely moveable both forwards and backwards. The figure in *Règne Animal* incorrectly represents the pelvic spine with two backwards moveable pieces. The dewlap is large, triangular, with the lower part arched, scaleless and half transparent; in it are enveloped upwards of 33 tendinous lines, the points of which slightly project beyond the margin; as many of them are divided, they have the appearance of rays. The shape of the expanded dewlap is in early age triangular; with age the posterior angle becomes truncated. The base of the triangle equals the length of the pelvic spine; the arched lower margin is by one third shorter. When the dewlap is expanded, the vertical diameter at the first dorsal spine is contained  $1\frac{2}{3}$  times in the total length; between the posterior dorsal and the anal it is  $2\frac{1}{2}$ .

The whole body is covered with minute crowded, backwards directed spines; near the upper and lower margin of the tail appears a longitudinal series of four larger scales, each armed with a short but strong

forwards arched spine. Individuals less than about 4 inches in length, present no trace of these spines. This species has a lateral line, the course of which is distinguished by a line of spines a little larger than the rest. It commences at the posterior margin of the orbit, ascending slightly towards the posterior dorsal, when it abruptly descends towards the middle of the side, and then continues straight to the caudal. At its origin it gives off a short vertical branch to the root of the first dorsal spine; a second above the orbit and nostril towards the muzzle; a third along the lower margin of the orbit, where it subdivides in an upper branch which proceeds horizontally to the chin, and in a lower undulating obliquely downwards to the dewlap. At Pinang this species is numerous at all seasons.

MONACANTHUS PENICILLIGERUS, (Péron.)

*Balistes penicilligerus*, Péron.

*Monacanthus penicilligerus*, Cuv. R. A. II. 374 (\*), Pl. XI. Fig. 3.

*Chaetodermis penicilligerus*, Swainson, II. 327.

Ground-colour pale whitish green, with numerous black lines; those round the orbit radiating, those of the rest of the head and the body longitudinal, undulating; side by side, behind and between the eye and gill-opening, two large round purplish black spots, both longitudinally divided by a band of brilliant ultramarine, through which passes one of the black lines of the body; behind the orbit a smaller purplish black spot, edged with pale blue, and three similar, vertically placed between the middle of the posterior dorsal and the anal; along the base of the latter fins, the dewlap and the caudal several irregular black spots; spines of the body hyaline; lips and filaments whitish red, the latter dotted and ringed with black; dorsal spine whitish grey with black spots; membrane hyaline, dotted with brown; fin-rays brownish white; membranes hyaline; those of the posterior dorsal, caudal and anal with numerous small rounded black spots placed in series parallel with the base of the fins. Pupil black, horizontally elliptical; iris golden bronze, with six radiating pale crimson bars.

D 1—23 or 26, C 10½, A 21 or 24, P 13, Br. V.

HABIT.—*Sea of Pinang, Singapore.*

TOTAL LENGTH: 6½ inch.

The form is rhombic, but appears shorter and broader than that of

*M. geographicus*. The length of the head from the muzzle to a little behind the orbit, is contained  $3\frac{1}{2}$  times in the total. The posterior margin of the orbit is situated nearly in the middle between the dorsal spine and the gill-opening the horizontal diameter of the eye is  $\frac{1}{2}$  of the length of the head; the horizontal diameter between both exceeds the diameter by  $\frac{1}{2}$ . The nostrils, lips, teeth and tongue resemble those organs of *Balistes conspicillum*. The upper branchiostegous ray is the longest, and closely attached to the second, which at its root appears to be double; the fourth is setaceous like the preceding, but a little removed from them; the fifth is broader than the rest, but less so than it is in *M. geographicus*. The dorsal spine is proportionally longer in young individuals; it is tetragonal, slightly arched backwards, and is armed with strong thorns on the four margins and it carries numerous long filaments like those of the body. It can but slightly be reclined; its length is less than  $\frac{1}{2}$  of its distance from the muzzle; its membrane descends from the middle of the posterior surface, and extends to a little in front of the middle of the distance between the two dorsals. There appears to be no second spine. The interval between the dorsal spine and the first ray forms three slight undulations, and slightly exceeds the length of the spine. The length of the rays of the posterior dorsal differs but slightly; those in the middle, the longest, are  $\frac{1}{2}$  of the spine. The extent of the base equals the distance from the muzzle to the dorsal spine. The anal commences opposite the 4th or 5th ray of the posterior dorsal, but it terminates opposite the latter. The distance of both from the caudal is  $\frac{1}{2}$  of the extent of the posterior dorsal. The caudal is nearly rhomboidal; the length of the central rays is  $\frac{1}{2}$  of the total. The pectorals are rounded, their length equals that of the longest rays of the posterior dorsal. The pelvic spine is very strong, less protractile than that of *M. geographicus*, but the jointed apex is more projecting; the dewlap is small, triangular, the anterior margin and the base equal the length of the caudal; the posterior margin is  $\frac{1}{2}$  less. When the dewlap is protracted, the vertical diameter between the root of the dorsal spine and apex of the pelvic is contained  $1\frac{1}{2}$  times in the total length; at the second dorsal it is  $2\frac{1}{2}$ . The body is very rough, covered with short strong spines, generally terminating in two, but frequently in more points, of which the posterior is longer than the rest and directed obliquely backwards. The spines of the body are

disposed in longitudinal series; those of the head are smaller, crowded and not in series; those of the tail are different from those of the rest of the body. No lateral line is perceptible. The filaments of the body are rather long, varying from one to three diameters of the eye; they consist of a main trunk, tapering to a brush of fine branchlets, and from three to seven lateral branches, placed in quincunx, each subdivided in minor branches, with fine brush-like points. On the sides of the head and body the filaments are few and widely scattered; they appear in greatest number round the lips, on the forehead, on both sides of the dorsal spine, in the interval between the dorsals, and on the margin from the chin to the apex of the pelvic spine. Two individuals,  $3\frac{1}{4}$  and  $4\frac{1}{4}$  inches in length, were observed at Singapore in May 1840, a third,  $6\frac{1}{4}$  inch, occurred at Pinang in October 1844.

GEN. ALUTARIUS, Cuvier, 1817.

Body elongated, covered with minute close granules, scarcely visible to the naked eye; a single spine in the anterior dorsal fin; pelvis entirely hid beneath the skin and without the spinous projection of *Balistes* and *Monacanthus*.

ALUTARIUS OBLITERATUS, Cantor.

*Balistes monoceros*, Bloch, Tab. 147?

*Balistes monoceros*, Shaw, V. 399, (excl. Syn. *B. monoceros*, Linné)  
Pl. 168?

*Alutera*: Bloch, 147, Cuv. R. A. II. 374 (\*)?\*

*Alutera monoceros*, Bloch 147, Swainson, II. 327?

(Young,  $3\frac{1}{4}$  inch in length.) Head above and back pale blackish brown; upper half of the sides pale yellowish olive, with numerous half effaced, irregular, blackish brown spots; lower half of the sides, throat and abdomen light impure greenish yellow, pale silvery; first dorsal spine, membrane and caudal yellowish olive, the latter with three backwards arched, indistinct blackish bands, of which the anterior a little behind the root, the second in the middle, the third along the posterior margin; posterior dorsal, anal and pectorals pale transparent yellowish. Iris greenish yellow.

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\* According to Cuvier different from *Balistes monoceros*, Linné, Catesby, 19. (*Règne Anim.* l. c.)

( $7\frac{1}{2}$  inch in length.) Ground-colour darker; back with numerous oblique or vertical spots; sides of head, body and abdomen with similar larger ones of irregular form, all the spots of a pale, half-effaced, blackish colour; caudal rays yellowish olive, membrane hyaline, closely and minutely dotted with black; posterior margin blackish.

D 2—46 or 47, C  $10\frac{1}{2}$ , A 47, 48 or 49, P 14, Br. VI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH :  $7\frac{1}{2}$  inch.

The form is broad lanceolate, the abdominal profile a little more arched than the dorsal. The length of the head, from the chin to a little behind the orbit, is about  $\frac{1}{3}$  of the total. The eye is situated in the centre between the first dorsal spine and the upper extremity of the gill-opening; the horizontal diameter is a little less than  $\frac{1}{2}$  of the length of the head. The frontal outline gently slopes from the first dorsal spine to the muzzle; that of the throat is more oblique and continues in a moderate arch to the anus. The horizontal distance between the eyes exceeds that diameter of each eye by  $\frac{1}{3}$ . In front of the eye appear two tubular nasal apertures, contiguous and both directed backwards; the anterior is the larger and closed by a small membranous valve. The lips are very thin, membranous and scarcely cover the teeth. The latter are very pointed; in other respects they as well as the tongue resemble those organs of *Balistes conspicillum*. The linear gill-openings are placed obliquely, with the upper extremity opposite the posterior margin of the orbit, the anterior extremity extends a little farther than the orbit; in its course the gill-opening deviates a little downwards from the corresponding profile of the forehead; its length exceeds by  $\frac{1}{2}$  the horizontal diameter of the eye. The five superior branchiostegous rays are setaceous, gradually decreasing in length towards the sixth, which is the shortest, and broad, like a sabre. The first dorsal spine is rather slender slightly arched, tetragonal and armed with thorns on all four margins; the membrane is very small and completely covers the second spine. The latter is excessively minute, yet distinct. The length of the first spine equals that of the gill-opening; its distance from the muzzle is  $\frac{1}{3}$  of that of the body, not including the caudal; from the posterior dorsal it is a little less. The latter interval deviates but slightly upwards from the horizontal. The second dorsal commences a little in front of the centre of the total length; it is generally low; the longest

rays, towards the middle, equal the length of the gill-opening; the base is sloping, and equals the distance between the chin and the first dorsal spine. The interval between the last dorsal and root of the upper caudal ray is contained  $2\frac{1}{2}$  times in the extent of the posterior dorsal fin, it equals the vertical diameter of the root of the caudal, but it is  $\frac{1}{2}$  of the length of the latter. The anal commences a little in front of the posterior dorsal, and terminates a little farther back. In very young individuals the caudal is bluntly pointed,  $\frac{1}{2}$  of the total length; in older ones it becomes rounded, and scarcely exceeds  $\frac{1}{2}$  of the total. The rounded pectorals commence behind the lower half of the gill-opening, which latter they scarcely exceed in length. The greatest vertical diameter of the body, at the first dorsal spine, is  $\frac{1}{2}$  of the total length; that at the first ray of the posterior dorsal is less by  $\frac{1}{4}$ . Four solitary individuals were at considerable intervals observed at Pinang. Shortly after death the spots of the body almost entirely disappear, and specimens preserved in spirits of wine acquire a pale dark slate-colour. They might be mistaken for *Alutarius berardi*, Lesson,\* but the latter species is distinguished by a proportionally shorter head, a smaller eye; the anal fin commences a little behind the posterior dorsal, and the distance between the latter and the caudal equals the length of the caudal, and is consequently proportionally greater.

#### ALUTARIUS LÆVIS, (Bloch.)

*Balistes scriptus*, Osbeck, Voyage, 1. 174 ?

*Balistes lævis*, Bloch, Tab. 414.

*Balistes monoceros*, Solander.

*Balistes lævis*, Shaw, V. 405.

*Alutera lævis*, Cuv. R. A. II. 374 (\*)

*Alutera lævis*, Swainson, II. 327.

*Aleuterus lævis*, Richardson, Ichth. of Sulph. 131, Pl. 61, Fig. 3.

*Aleuterus lævis*, Richardson, Report, 1845, 202.

Ground-colour bright yellowish green olive; round and beneath the

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\* Voy. de la Coquille, Ichth. 107, Pl. 7. SYN. *Aleuterus berardi*, Richardson, Ichth. of Sulph. 132, Pl. 61, Fig. 1.—*Aleuterus berardi*, Richardson, Report, 1845, 202 and 318.—*A. cinereus*, Temminck et Schlegel: Fauna Japonica: Pisc. Tab. CXXXI. Fig. 1.

orbit, between the two dorsals, on the cheeks, throat and abdomen single short, longitudinal or oblique, ultramarine bands; the rest of the head and body with numerous distant rounded ultramarine spots; first and second dorsal spine, and their membrane, and the caudal rays yellowish olive, dotted with black; caudal membrane pale greenish white, densely dotted with brown and with four indistinct reddish brown bands, of which the anterior a little behind the root of the fin, the fourth on the posterior margin; rest of the fins hyaline. Iris golden bronze, orbital margin blackish.

D 2—46, C 10½, A 49, P 14, Br. VI.

HABIT.—*Sea of Pinang.*

Indian Ocean, Canary Islands, Carribean Sea, China Sea.

TOTAL LENGTH: 9½ inch.

The form is elongated lanceolate, broader at the tail than at the muzzle. The length of the head is contained  $3\frac{1}{2}$  times in the total. The length of the head, from the chin to a little behind the orbit, is contained  $3\frac{1}{2}$  times in the total. The eye is situated between the first dorsal spine and the upper extremity of the gill-opening, a little closer to the former than to the latter; the horizontal diameter is  $\frac{1}{2}$  of the head. From the muzzle the profile gently ascends to the first dorsal spine, the corresponding profile, from the chin to the anus, describes a gently rising arch, so that the outline of the head is elongated conical with the point truncated. The horizontal distance between the eyes equals two diameters. The nostrils, lips, teeth and tongue resemble those organs of *A. obliteratus*. The upper extremity of the oblique linear gill-opening is situated in the middle between the centre of the lower orbital margin and the root of the pectorals; the lower extremity extends to a little in front of the orbit; the length equals the horizontal diameter of the eye. The first dorsal spine is slender and flexible and covered with granules like those of the body; its length is  $\frac{1}{2}$  of its distance from the muzzle, which is contained  $4\frac{1}{2}$  times in the total length. The membrane is small completely hiding the minute second dorsal spine. The groove of the back is  $\frac{1}{2}$  of the length of the first spine which, however, does not sufficiently recline, so as to come in contact with the back. The interval between the two dorsals ascends gently backwards, and equals the distance from the muzzle to the anterior margin of the orbit. The posterior dorsal is low, the longest rays exceeding the horizontal



diameter of the eye by  $\frac{1}{4}$ ; the extent of the base equals the distance from the muzzle to the first dorsal spine; the distance between the last dorsal and the root of the upper caudal ray equals the vertical diameter at the root of the caudal both are contained  $2\frac{1}{4}$  times in the extent of the base of the posterior dorsal. The anus is situated opposite the third ray of the posterior dorsal; the anal commences opposite the 6th, and extends farther back than the opposite fin, which it otherwise resembles. The caudal is very large, broad oval; the central rays, the longest, equal the length of the head. The rounded pectorals slightly exceed the longest dorsal rays. The vertical diameters at the first dorsal spine and at the first dorsal ray, equal the distance between the spine and the muzzle; in the centre between the two dorsals the diameter equals the head. A single individual was observed at Pinang in December 1842. Shortly after death the body became shining blackish, a shade lighter than the blue marks, which changed to intense bluish black.

ALUTARIUS BARBATUS, (Gray.)

Plate VIII. Fig. 1.

(Icon.) Balistes (Anacanthus) barbatus, Gray: Ill. Ind. Zool. I.

Pl. 84, Fig. 2.

Anacanthus\* barbatus, Gray: Zool. Miscell. 8.

Psiloecephalus† barbatus, Swainson, II. 327.

\* The following are Mr. Gray's characters: "ANACANTHUS. Body long, lanceolate, compressed, covered with small scales; head produced, beak-shaped, mouth small; under lip one bearded; pelvis produced, bag-like, with a single rather long spine in front; dorsal fin one, long; anal long; tail long, lanceolate; most allied to *Alutera* (see *Aluteres*, Cuv.).

"*Anacanthus barbatus*, Illust. Ind. Zool. Pisc. t. 1. f. 2. Brown, rather paler beneath; under part of the jaws, body and ventral pouch whitish, marbled with black lines; anal fin produced a little beyond the dorsal fin; tail nearly half as long as the body, D 46, V 11, A 60, P 8? Singapore." (Zool. Miscell. 1831, p. 8.)

Comparison of preserved specimens of this fish with the plate in the Illustr. of Ind. Zoology, leaves little doubt that the latter is an incorrect copy. The draughtsman has overlooked the anterior dorsal fin, and added a ventral spine and pouch. These two are the principal distinguishing characters of the Gen. *Anacanthus*. Both, however, are erroneous: the fish is a true *Alutarius*, and the genus *Anacanthus* is inadmissible.

† PSILOCEPHALUS, Swainson, 1839, is a second genus founded upon the figure of *Anacanthus barbatus* in Ill. Ind. Zool. It is thus doubly inadmissible being a synonyme of *Anacanthus*, and being founded upon erroneous characters.

Dark bluish green slate-coloured ; filament of the chin black ; spine of the anterior dorsal pale bluish green, membrane hyaline, minutely dotted with black ; posterior dorsal, anal and pectorals transparent brownish white, rays pale yellowish brownish yellow ; caudal rays yellow, membrane black. Pupil black, horizontally oval ; iris silvery.

$$D \begin{cases} 1-44, \\ 1-47, \\ 1-50, \\ 1-51, \end{cases} C \ 8\frac{1}{2}, A \begin{cases} 65, \\ 61, \\ 62, \\ 59, \end{cases} P \ 9, Br. \ VI.$$

HABIT.—*Sea of Pinang, Singapore.*

TOTAL LENGTH :  $9\frac{1}{2}$  inch.

The form of the body is narrow, very elongated, resembling the blade of a knife ; the sides compressed, the abdomen nearly trenchant. The head is very elongated, gradually attenuated towards the muzzle ; its length from the chin to a little behind the orbit is  $\frac{1}{2}$  of the total, or very little more or less. The eye occupies the commencement of the posterior fifth of the head : it is situated beneath the spine of the anterior dorsal, close to, without encroaching upon the profile ; the horizontal diameter is  $\frac{1}{5}$ , rarely  $\frac{1}{4}$  of the length of the head ; the horizontal distance between the eyes is but  $\frac{1}{4}$  of their diameter. The two apertures of each nostril are minute, tubular, opening side by side immediately in front of the anterior margin of the orbit. The lower jaw is longer than the upper, beyond which the rounded chin projects ; the mouth is a small transversal cleft which opens vertically on the upper part of the muzzle ; the lips are thin, membranous ; the teeth, apparently 8 in the upper, 6 in the lower jaw, do not differ from those of the preceding species of *Alutarius*. To the chin is attached a vertical, soft, fleshy filament, tapering from the base into a sharp point, its length exceeds  $\frac{1}{2}$  of the head. Between the branches of the lower jaw, from behind the filament to the lower extremity of the gill-opening, the skin of the throat is lax and forms a kind of narrow, slightly downwards arched dewlap. The floor of the mouth rises gradually towards the second third of the head, where the three very elongated branchial arches commence. The rest of the cavity is a very narrow tube which closely follows the gently backwards ascending profile of the forehead. No distinct tongue is visible. The gill-opening is linear, downwards arched, and very oblique ; it commences beneath the anterior angle of the orbit, on a level with the root of the pectorals, the distance from which, as well as

the length of the opening itself, but slightly exceeds the horizontal diameter of the eye. The branchiostegous rays are setaceous. The pelvic spine is narrow like the blade of a sabre, and in six individuals examined, so completely hid in the integuments, as not even to encroach upon the abdominal profile which is very slightly arched. Nor did they offer the least trace of a triangular dewlap, as represented in the figure Hardwicke's Illustrations. The profile of the back rises but little and slowly from the muzzle to the posterior dorsal, from the termination of which it gently descends; the abdominal outline is but little more arched. The anterior dorsal consists of a single spine placed above the pupil, in front of the pectorals; it is very slender, setaceous, covered with minute spines; in all individuals observed, it reclined in its dorsal groove, but might readily be raised; the membrane is small triangular, apparently without a second spine. The distance between the dorsal spine and the posterior dorsal fin is by  $\frac{1}{4}$  shorter than that between the spine and the chin. The upper margin of the posterior dorsal is a little arched; the rays towards the middle are the longest, and equal the length of the spine; the extent of the base exceeds by about  $\frac{1}{4}$  the length of the head; the interval between the last dorsal and the root of the upper caudal ray varies from a little less than  $\frac{1}{4}$  of, to  $2\frac{1}{4}$  times in the extent of the fin. The anal resembles the posterior dorsal, but it commences a little more forwards behind the anus, and is carried farther backwards, so that its extent at the base exceeds that of the former by  $\frac{1}{4}$  or  $\frac{1}{2}$ , while its distance from the caudal is  $\frac{1}{4}$  less than that of the former. The caudal is very elongated, lanceolate; the two upper and lower rays are, like those of the other fins, undivided; the margins of all rays have a series of microscopic spines. On each side of the root of the caudal appears a triangular pointed space, covered with minute hair-like spines, like the rest of the body. The length of the central rays vary in the different individuals from  $2\frac{1}{4}$  times in, to  $\frac{1}{4}$  of the total. The upper rays of the pectorals, the longest, slightly exceed  $\frac{1}{4}$  of the length of the head. The body is covered with little rounded scales and has a fine velvety appearance from its being densely covered with minute, microscopic spines. The lateral line is so fine that it is hardly visible to the naked eye. Behind the orbit, at its origin, it sends two branches round the orbit, of which the upper one accompanies the pro-

file to the muzzle, the lower ascends to a little in front of the eye and then proceeds parallel to the upper branch. The main trunk at first ascends obliquely, but soon descends with 3 to 4 short undulations to a little in front of the posterior dorsal, from whence it continues in the middle of the side and terminates at the apex of the scaly part of the caudal. The vertical diameter at the upper lips slightly exceeds  $\frac{1}{4}$  of the length of the head; at the dorsal spine it is a little less than  $\frac{1}{4}$ ; the greatest, between the two dorsals is  $\frac{1}{3}$ ; at the root of the caudal it is a little less than  $\frac{1}{3}$  of the head. The greatest horizontal diameter, or thickness of the body, is a little behind the anterior dorsal fin, where it equals  $1\frac{1}{2}$  diameters of the eye; from thence it gradually decreases and becomes trenchant towards the tail like the entire abdominal part of the fish. A single mutilated individual was observed at Singapore in May 1843; five others, of which the smallest measured 8 inches in length, occurred at Pinang in the following November, in February and August and December 1844, and in June 1845. After death the colour of the body changes to a dusty pale reddish brown, dotted with black, the caudal membrane turns pale bluish grey; the arched lax skin of the throat shrivels up, so as scarcely to be visible.

GEN. *TRIACANTHUS*, Cuvier, 1817.

With a kind of ventrals, each supported by a single large spinous ray, adhering to a not salient pelvis; anterior dorsal with three or four small spines behind a very large one; skin covered with crowded small scales; tail longer than in the other sub-genera.

*TRIACANTHUS BIACULEATUS*, (Bloch.)

*Balistes biaculeatus*, Bloch, Tab. 148, Fig. 2.

Russell, XXI. Bowree, or Abatoo.

*Balistes biaculeatus*, Shaw, V. 415, Pl. 169.

*Triacanthus biaculeatus*, Cuv. R. A. II. 374 (\*).

*Triacanthus biaculeatus*, Bennett: Life of Raffles, 693.

*Balistes biaculeatus*, Bennett: Fishes of Ceylon, No. 15, (*Young*.)

*Triacanthus biaculeatus*, Swainson, II. 326.

*Triacanthus biaculeatus*, Richardson: Rep. 1845, 202.

*Triacanthus biaculeatus*, Bleeker: Verh. Batav. Gen. XXII. 6.

Head above and back pale blackish green, lighter on the sides above the lateral line ; rest of the sides of body and head and abdomen frosted silvery ; in some a faint blackish spot a little below the eye ; first dorsal spine silvery blackish, the rest white ; the basal half of the spines as well as the yellowish membrane black ; ventral spines silvery white ; rest of the fins pale yellowish, in some the margins blackish. Iris pale golden, bluish black towards the orbit.

D 5—24 or 25, C 14½, A 19 or 20, V 1, P 14, Br. VI.

HABIT.—*Sea of Malayan Peninsula and Islands,*

Indian Ocean, Ceylon, Bay of Bengal, Sumatra, Java, Borneo, Madura, Sumbawa, Celebes, Seas of China and Australia.

TOTAL LENGTH : 9 inch.

The form is trapezoid, approaching the rhomboidal. The head is broad, pyramidal, tapering to an elongated muzzle ; the length from the latter to the gill-opening varies from  $\frac{1}{2}$  of to  $4\frac{1}{2}$  times in the total. The eye borders upon the profile ; the anterior margin of the orbit is situated opposite the commencement of the posterior third of the head ; the oblique diameter is  $\frac{1}{2}$  of the length of the head ; the distance of the eyes between the anterior angles equals the diameter, between the posterior angles it is  $\frac{2}{3}$  more. The two tubular apertures of each nostril are placed obliquely in front of the eye upon the profile ; the upper aperture is oval, larger than the lower, rounded one. The small mouth is surrounded by thick fleshy lips ; each jaw has an external series of 10 trenchant teeth, of which the central ones are the largest ; in the upper jaw appears a second transversal series of four tubercular teeth, of which the central pair are the larger ; in the lower the corresponding series consists but of two tubercular teeth, immediately behind the pair on the symphysis. The tongue is small, fleshy, oval and tied to the floor of the cavity. The gill-opening is linear, slightly oblique, situated immediately in front of the pectorals ; the length nearly equals the diameter of the eye. The distance from the muzzle to the root of the first dorsal spine varies from  $\frac{1}{2}$  of to  $3\frac{1}{2}$  times in the total length. The spine is strong, covered to the apex with small bipartite or tripartite spines ; in young individuals its length equals the greatest vertical diameter of the body, in older ones it is  $\frac{1}{2}$  to  $\frac{1}{3}$  less. The second spine is much shorter, slenderer, and but slightly rough on the posterior margins ; its length varies from

$\frac{1}{4}$  to  $\frac{1}{2}$  of the former ; the succeeding rays gradually decrease in length, the last one varying from  $\frac{1}{4}$  to  $\frac{1}{2}$  of the second ; the connecting membrane is a little shorter than the spines ; the extent of the anterior dorsal slightly exceeds  $\frac{1}{2}$  of the distance from the first spine to the first ray of the posterior dorsal, which varies from  $\frac{1}{4}$  of to  $5\frac{1}{2}$  times in the total length. The posterior dorsal is low, gradually rising from the first, undivided, ray to the sixth, and then slowly decreasing ; the longest ray is  $1\frac{1}{2}$  diameter of the eye ; the extent of the fin nearly equals the length of the head ; the distance from the root of the upper ray of the caudal varies from  $\frac{2}{3}$  to  $\frac{1}{2}$  of the extent. The anal is falcated ; it commences opposite the 9th or 10th ray of the posterior dorsal, and terminates opposite the last ray ; the first ray is undivided,  $\frac{1}{2}$  of the second, the longest, which varies from  $1\frac{1}{2}$  to 2 diameters of the eye ; the succeeding rays suddenly decrease to the 11th or 12th, from whence the remaining rays are but  $\frac{1}{4}$  of the longest. The anus is situated immediately in front of the fin. The caudal is deeply divided in two pointed, or a little rounded lobes, of which the upper one is generally the longer, equalling the extent of the posterior dorsal. The pectorals are rounded, their length varying from  $1\frac{1}{2}$  to two diameters of the eye ; they are placed immediately behind the gill-opening, opposite the first dorsal and the ventral spines, but nearer the latter. These spines are as strong, and rough as the first dorsal, but shorter, their length varying from  $\frac{1}{4}$  to a little more than  $\frac{1}{2}$  of the head ; each is attached by a short thick rough membrane to its respective groove on each side of the very elongated, flattened pelvic spine, which is covered with little scales, not different from those of the rest of the body. The latter are very small, sub-rhomboidal with the vertical diameter much longer than the horizontal. Each scale (Plate IX., Fig. 3. Magnified.) carries a single vertically placed crest, which is armed with from 4 to 15 excessively minute spines. The skin is rough to the touch in every direction. The hair-like lateral line commences behind the orbit, describing a wide arch which terminates opposite the posterior third of the posterior dorsal, from whence it proceeds in the middle of the side of the tail to the caudal. At its origin the line gives off the following branches ; a vertical, anastomosing in front of the dorsal spine with the one from the opposite side ; a second along the supraorbital margin, in front of the nostril, along the profile to the muzzle ; a third along the infraorbital margin, obliquely undulating over

the cheek ; a little behind the mouth it suddenly ascends to join the opposite corresponding branch ; a fourth descends a little in front of the gill-opening, beneath which it forms a short arch backwards, and then proceeds obliquely downwards to the middle of the ventral groove. At Pinang and at the Sandheads young individuals are excessively numerous at all seasons ; larger ones are rarely seen, particularly in the latter locality.

TRIACANTHUS STRIGILIFER, Cantor.

Plate IX. Fig. 1 and 2.

(*Young ?*) Head above and back pale sea-green, changing to bluish white on the upper half of the sides ; lower half and abdomen frosted silvery white ; back and sides with a few orange spots of irregular form, viz. an elongated spot between the eyes towards the nostrils ; a second, broad rhomboidal surrounding the base of the anterior dorsal, and sending a vertical branch, with rugged margins, down to the gill-opening ; a third oblique spot from the third to the eleventh ray of the posterior dorsal ; immediately behind the mouth a vertically placed pair of small spots ; a pair of larger ones, of which the lower like a horse-shoe, on the cheek beneath the nostril ; beneath the eye a horizontal band to the lower part of the gill-opening ; in the axilla a short horizontal band, giving off an irregular branch towards and above the anal, and a longer arched one to opposite the middle of the posterior dorsal ; at a short interval another horizontal band terminating in the middle of the side, a little behind the posterior dorsal ; in the centre of the base of the caudal a small rounded spot ; on the posterior half of the tail a broad forwards pointed spot of bright yellowish green ; first spine of anterior dorsal pale sea-green, minutely dotted with black ; the succeeding spines white ; membrane hyaline, minutely dotted and edged with black ; pectorals and ventral spines white ; rays of the rest of the fins yellowish white, membranes hyaline. Pupil horizontally oval, black ; iris light yellow golden, orbital margin greenish black.

D 5—22, C 12½, A 16, V 1, P 13, Br. VI.

HABIT.—*Sea of Pinang,*

TOTAL LENGTH : 6½ inch.

This species differs from the preceding by its more elongated, less deep form, by its larger eye, its peculiar scales, its longer second dorsal

spine, its number of finrays and colours. From the muzzle to the lower angle of the gill-opening the head is  $\frac{1}{4}$  of the total length. The eye borders upon the profile, occupying the posterior third of the length of the head, of which the horizontal diameter is  $\frac{1}{3}$ ; the distance between the anterior angles of the eye equals the diameter; that between the posterior ones is  $\frac{1}{2}$  longer. The nostrils, lips, teeth and tongue resemble those organs of *T. biaculeatus*, but the gill-opening is proportionally shorter, being but  $\frac{2}{3}$  of the diameter of the eye. The distance from the muzzle to the first dorsal spine is a little less than  $\frac{1}{2}$  of the total length. The spine resembles that of *T. biaculeatus*, equaling the greatest vertical diameter of the body. The second spine is remarkably long,  $\frac{1}{2}$  of the former, and the length of the connecting membrane corresponds; the extent of the fin, and its distance from the posterior dorsal are the same in both species. The longest ray of the posterior dorsal is proportionally shorter, being  $\frac{2}{3}$  of the diameter of the eye, but its distance from the caudal is greater: it equals the extent of the base, which is  $\frac{2}{3}$  of the length of the head. The falcated anal commences opposite the 12th ray of the posterior dorsal, and terminates opposite the last ray; the longest ray slightly exceeds the diameter of the eye; the extent of the base is proportionally shorter than in *T. biaculeatus*. The caudal is less deeply cleft almost crescent-shaped; the lobes equal; their length is contained  $4\frac{1}{2}$  times in the base of the posterior dorsal. The pectorals are rounded, their length slightly exceeding the diameter of the eye. The ventral spines resemble those of *T. biaculeatus*; but the intermediate pelvic spine is in the present proportionally longer, and covered with larger scales, entirely different from those of the rest of the body; their form is hexagonal with excessively minute spinous crests radiating to the margins. The scales of the body (Plate IX. Fig. 2. Magnified), although small, are perceptibly larger than in *biaculeatus*, and with their horizontal diameter longer than the vertical; their form is nearly rhombic with from three to seven vertical or oblique crests, each of which is armed with three to seven excessively minute spines. Each scale thus resembles a small curry-comb, which makes the skin in every direction rough to the touch. The main trunk of the lateral line resembles that of *biaculeatus*, but it gives off an additional vertical branch to the middle of the root of the first dorsal spine, a little behind the anterior anastomosing one. The



two branches surrounding the eye can be traced no farther than the region of the nostrils; and the one in front of the gill-opening appears to terminate at the lower angle of the opening. A solitary individual occurred at Pinang in June 1845. Several years before, the existence of a second species of *Triacanthus* was positively asserted by fishermen who described it as being very rarely seen, and of a size somewhat smaller than *T. biaculeatus*.

### FAM. OSTRACIOIDÆ.

GEN. OSTRACIUM, (Linné, 1748) Cuvier, 1817.

Head and body covered with bony, regular plates, instead of scales, soldered so as to form a kind of inflexible armour; the tail, fins, mouth and a kind of small lip covering the margin of the gill-opening are the only moveable parts, all passing through holes in the armour, also the greater number of vertebræ are soldered together; each jaw with 10 to 12 conical teeth; ventral fins and pelvis none; dorsal and anal small; branchiostegous rays six.

#### OSTRACIUM CORNUTUM, Linné.

*Ostracion cornutus*, Linné: Mus. Ad. Fr. I. 59.

*Ostracion cornutus*, Linné: Syst. 1443.

*Ostracion cornutus*, Bloch. Tab. 133.

*Ostracion cornutus*, Bloch-Schneider, 500.

*Ostracion cornutus*, Shaw, V. 423, Pl. 170.

*Ostracion cornutus*, Cuv. R. A. (I. Ed.) II. 154 (\*).

*Ostracion cornutus*, Bennett: Life of Raffles, 693.

*Lactophrys*\* *cornutus*, Swainson, II. 324.

*Ostracion cornutus*, Richardson, Report, 1845, 200.

*Ostracion cornutus*, Temm. et Schl. Fauna. Jap. Pisces, Tab. CXXXI.

Fig. 4, (Young.)

Buntal kumbang of the Malays.

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\* *Lactophrys*, Swainson, 1839. In *Nomenclator Zoologicus, Pisces*, p. 33, this Sub-Genus is by mistake written *Laetophrys*, while in *Addenda*, p. 3, *Lactophrys*, De Kay, 1842, is quoted as a distinct genus. In the *Zoology of New York*, III. 341, *Laetophrys* is quoted with the evidently accidental omission of the name of the founder, but the characters are those of Mr. Swainson. (*Nat. Hist. of Fishes*, &c. II. 324.)

*Young.* (Without spines; 1 inch in length.) Upper surface and sides pale greenish yellow, with a sky-blue central spot in some of the hexagons, and here and there with a single brown spot; abdomen light reddish yellow; generally with a single brown spot on the throat, and one or two on the anterior part of the lateral margin; fins hyaline.

*Older.* Upper surface and sides pale greenish olive, minutely dotted with black, with a central sky-blue spot in each hexagon; abdomen yellowish white; fins transparent pale olive; caudal minutely dotted with black; posterior half blackish; spines buff, minutely dotted with black. Iris bright yellow, orbital margin orange or red; pupil obliquely oval, iridescent black.

D 9, C 8½, A 9, P 11, Br. VI.

*HABIT.*—*Sea of Malayan Peninsula and Islands.*

Chinese Seas, Canton, Japan.

**TOTAL LENGTH:** 6 inch.

The form of the body is tetragonal, with the lower surface broader than the upper, and the sides concave. The length of the head is  $\frac{1}{4}$  of the total. The forehead is at a nearly right angle with the vertex; the vertical diameter through the eye, the greatest of the body, is contained  $3\frac{1}{4}$  times in the total length; that through the gill-opening is a little shorter; at the termination of the armour it is  $5\frac{1}{4}$  times in the total length. The eye is situated close to the frontal angle; the greatest oblique diameter is  $\frac{1}{2}$  of the length of the head. Above each eye rises a subular, forwards, upwards and outwards directed spine, granulated at the base; the rest finely fluted; the length equals the head. The distance between the eyes across the vertex is excavated, a little less than two diameters. The nostrils have two minute, apparently papillular apertures, placed in a small, nearly vertical furrow close to the anterior angle of the eye. A little in front of the lower aperture appears a minute papilla. Each jaw has a single series of ten small conical teeth, almost entirely hid by the fleshy lips; the teeth are of a dark amber or chestnut brown; the four above the symphysis of the lower jaw are a little longer than the rest. The mouth is very small; the tongue is minute, fleshy and completely tied to the floor of the mouth; behind the tongue there is a small raised step, leading into a tunnel, on each side supported by the four branchial arches. The sides of the back are angular, a little contracted in the middle. A little in front of the dorsal, at the

widest part of the back, appears on each side a small pointed tubercle, between which the distance equals the length of the head. The centre of the back is raised, so as to form a linear sharp keel which terminates in a small pointed tubercle in the middle between the two lateral ones. The abdominal surface is both longitudinally and transversely arched; the greatest transversal diameter, about the middle, is contained  $2\frac{2}{3}$  times in the total length. On each side of the termination appears a spine resembling the frontal ones, but pointed in an opposite direction and a little shorter. The armour is composed of pentagonal, hexagonal or heptagonal pieces with the margins finely toothed or ciliated. The pieces of the back and sides have each a tubercle in their centre, from which radiate a number of lines corresponding to the respective number of sides. On the pieces of the abdomen appear instead of lines a number of minute hemispherical tubercles. The dorsal fin is placed at a short distance from the termination of the armour above; its length is  $\frac{1}{2}$  of the head; the extent of the base is  $\frac{1}{2}$  of the length. The length of the small naked tail is contained about  $2\frac{1}{2}$  times in the elongated oval caudal fin. The rounded anal is situated above, yet between the posterior pair of spines, behind the dorsal which it resembles. The rounded pectorals are nearly  $\frac{1}{2}$  of the length of the head. The smallest individuals examined measured 1 inch in length. They had no spines, but in their places appeared tubercles. The central and lateral tubercles of the back were comparatively more developed than in the adult. In the middle of the upper pupillary margin of the iris appeared a small notch. The smallest ones, provided with blunted spines half the length of the head, measured  $1\frac{1}{4}$  inch in length. Young individuals are at Pinang numerous at all seasons.

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OSTRACIUM TESSERULA, Cantor.

Plate VIII. Fig. 2 and 3.

*Young.* Armour bright gamboge with numerous small black spots, not corresponding to the centre of the polygons, and fewer and more distant on the abdomen; tail bright gamboge with one or two black dots on each side of the root of the caudal; fins gamboge, a little paler than the body; pectorals with a single black dot at the root; caudal with the posterior margin pale blackish. Pupil transversely oval, black;

iris bright gamboge, orbital margin orange; in the middle of the upper pupillary margin a small notch.

D 9, C 8½, A 9, Br. VI.

HABIT.—*Sea of Pinang.*

TOTAL LENGTH: 2 inch.

The general form is tetragonal. The back is elongated oval, arched from the occiput to the tail; in the centre appears a short longitudinal crest, on each side of which is a deep furrow, laterally bounded by the sharp angular margin. By these three crests the vertical section in this particular region becomes pentagonal. The profile of the forehead is nearly straight and steep. The distance between the anterior angles of the orbits is  $\frac{1}{4}$  of the total length; the greatest breadth in the middle of the back is contained  $2\frac{1}{2}$  times in; above the naked tail it is  $\frac{1}{11}$  of the total length. The abdominal surface is both longitudinally and transversely arched, with a furrow along the angular margin; it is broader than the back, its greatest breadth, beneath the pectorals, varies from  $1\frac{1}{2}$  in to  $\frac{1}{2}$  of the total length. The sides are excavated with the lower margin projecting farther outwards than the upper; their greatest diameter is nearly in the middle and is contained  $2\frac{1}{2}$  times in the total length; but the vertical diameter of the central crest of the back is a little longer, owing to the central convexity of the abdomen. The armour is composed of hexagonal pieces with very finely toothed or ciliated margins. From the centre of each hexagon radiate towards the margins six raised lines of which the central, horizontal ones, join their neighbours, so as to form on the sides of the armour seven parallel, horizontally arched, lines, which form the bases of triangles produced by the other obliquely radiating lines. On the back and sides the triangles are very conspicuous, while the hexagonal outline of the component pieces can scarcely be traced. On the abdominal surface the reverse is the case. From the central tubercle radiate numerous fine lines; but the triangles are very indistinct. The length of the head is contained a little less than  $3\frac{1}{2}$  times in the total. The eye is situated close to the profile, nearly in the middle between the gill-opening and the muzzle; the horizontal diameter is  $\frac{1}{2}$  of the length of the head. The supraorbital arch forms a tubercular protuberance. The mouth, teeth, and tongue and nostrils resemble those of *O. cornutum*, but there appears to be no nasal papilla. The dorsal is placed close to the termination of the armour; the

upper margin slopes backwards ; the anterior ray, the longest, is  $\frac{1}{2}$  of the length of the head, of which the extent of the base is  $\frac{1}{4}$ . The anal is but little farther backwards than the dorsal, opposite the middle of which is placed the first ray ; in form and length it resembles the dorsal. The caudal is elongated oval ; its length  $\frac{2}{3}$  of the head. The pectoral is broad, nearly triangular ; the third ray, the longest, equals the caudal. This fish is of rare occurrence at Pinang. Of four individuals observed at irregular intervals, the length varied from 2 to 1 inch. They appear to be young individuals. The triangular partitions of the armour characterise *O. turritum*,\* Forskål. Possibly the present fish may be the young of that species, prior to the appearance of the spines and the full development of the dorsal crest.

#### OSTRACIUM NASUS, Bloch.

*Ostracion nasus*, Bloch, Tab. 138.

*Ostracion nasus*, Shaw, V. 426, Pl. 171.

*Ostracion nasus*, Cuvier, R. A. Ed. 1, II. 154 (\*).

*Ostracion nasus*, Swainson, II. 323.

Bántal pánjang of the Malays.

Upper surface pale brownish- or greenish olive, with numerous small rounded dark brown spots ; sides lighter of either colour ; in some the margins of the polygons dark brown ; abdomen either uniformly buff with the margins of the polygons pale lilac, or pale reddish yellow with the nuclei of the polygons greenish white ; the naked tail brownish olive, lighter on the sides, with numerous brown spots ; beneath greenish buff ; lips, margin of gill-openings and root of pectorals pale greenish olive with few brown spots ; fins pale transparent greenish olive ; a round brown spot at the root of each dorsal ray, and a few similar scattered over some of the caudal rays. Orbital half of iris pale greenish olive with few brown spots, rest bright yellow with a blackish or orange ring ; pupil black, circular.

*Young.* With a few rounded brown spots irregularly scattered over the sides.

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\* SYN. *Ostracion turritus*, Forsk. 5. 7, No. 113.—Bloch, Tab. 136 ;—Shaw, V. 426, Tab. 171 ;—Cuv. R. A. Ed. 1, II, 154 ;—Rüppell: Atlas, 5, and Neue Wirb. Fische, 61 ;—*Tetrasomus turritus*, Swainson, II. 323.

D 9, C 8½, A 9, P 11, Br. VI.

HABIT.—*Sea of Pinang, Malayan Peninsula.*

“Indian and American Seas,” (Bloch.)

TOTAL LENGTH : 7¼ inch.

The form is nearly quadrangular, as the breadth of the abdomen but slightly exceeds that of the back and the height of the sides. The back is elongated lanceolate ; from the nasal protuberance the profile gently ascends towards the middle of the back, when it slowly descends towards the tail, the whole forming a very low arch. From the occiput to near the dorsal the middle of the back is raised and forms a low triangular keel, on each side of which appears a shallow broad sulcus, outside bordered by the raised angular margin of the side. The triangular forehead slopes gently from the occiput and appears a little excavated owing to the broad protuberant supraorbital margins. The breadth between the anterior angles of the orbit is  $\frac{2}{3}$  of the length of the head ; between the posterior angles it equals the head ; the greatest breadth, in the middle of the back, exceeds the length of the head by  $\frac{1}{2}$ ,  $\frac{1}{3}$  or  $\frac{1}{4}$  according to the individually more or less projecting nasal protuberance ; the breadth at the termination of the armour is a little less than half the breadth between the posterior orbital angles. The nasal protuberance is blunt, rounded. In individuals 6¼ inch in length it scarcely projects beyond the mouth, immediately above which the profile rises vertically, and this portion measures  $\frac{1}{2}$  of the distance between the anterior angle of the orbit and the protuberance, which in them is  $\frac{1}{3}$  of the total length. In the largest individual, 7¼ inch in length, the protuberance perceptibly projects beyond the mouth, from which the profile projects obliquely and exceeds  $\frac{1}{2}$  of the stated distance, which is  $\frac{1}{3}$  of the total length. The sides are but little excavated ; their greatest vertical diameter corresponds to, but slightly exceeds, the greatest breadth of the back ; it varies from  $4\frac{1}{2}$  to  $4\frac{1}{3}$  times in the total length. The length of the head, from the nasal protuberance to the gill-opening, is in younger individuals, with the protuberance but little developed,  $\frac{1}{3}$  of the total, in older ones it is contained  $4\frac{1}{2}$  times in the total. The eye is close to the profile ; the posterior angle of the orbit is situated above the gill-opening. The greatest diameter is a little oblique, ascending backwards ; it is contained  $2\frac{1}{2}$  times in the distance from the mouth to the gill-opening, and this proportion appears to be constant. But as the development of the

nasal protuberance increases with age, so does the relative length of the diameter of the eye vary from  $2\frac{1}{2}$  times in to  $\frac{1}{2}$  of the distance, measured from the protuberance to the gill-opening. The nostrils, mouth and tongue resemble those of *O. tesseraula*. Each jaw carries a single close series of from 9 to 11 conical teeth of a chestnut or brown colour. The six central teeth of both jaws are a little larger than the rest and their points become blunted with age. The armour is composed of pentagons, hexagons and heptagons, with ciliated margins. Not including the lateral half-series, on the back and sides appear five longitudinal ones; nine pieces from the gill-opening to the tail. The abdomen is covered by nine longitudinal series of which the central one is composed of 12 to 14 pieces. All are closely covered with minute bony tubercles; generally arranged parallel to the margins. The dorsal commences opposite the anus; the upper margin is rounded; the third and fourth ray, the longest, slightly exceed  $\frac{1}{2}$  of the length of the head; the extent of the base is  $\frac{1}{2}$  of the length. The anal commences opposite the last ray of the dorsal, which it in form and length resembles. The caudal is broad triangular with the posterior angles and margin rounded; the two central rays, the longest, equal the head. The pectorals are broad triangular; the third and fourth upper rays are the longest,  $\frac{3}{4}$  of the length of the caudal. The length of the sides of the naked tail is  $\frac{1}{2}$  of the caudal. Single individuals, or two or three together, were observed at Pinang at long and irregular intervals. In size they differed but slightly, the smallest being  $6\frac{1}{2}$  inch in length.

## FAM. GYMNOTODONTIDÆ.

### GEN. DIODON, Linné, 1766.

All the teeth united into a single one in each jaw; behind the trenchant margin of each a rounded part, transversely furrowed and forming a powerful apparatus of mastication; the skin armed with stout spines; no ventral fins.

### DIODON TRIEDRICUS, Cuvier.

Seba, II. XXIII. 4.

*Diodon triedricus*, Cuvier: Mém. du Mus. IV. 133.

*Diodon triedricus*, Cuv. R. A. II. 367 (?).

Head above, back and sides to a little below the gill-opening pale tortoise-shell brown ; a transversal band composed of a large soot-coloured spot behind each pectoral, and a series of smaller spots across the back ; a second similar but paler band in front of the dorsal ; rest of the sides and abdomen yellowish white ; fins whitish grey, minutely dotted with brown ; all spines brown ; their roots of the colour of the part they occupy. (*From a preserved specimen.*)

D 12, C 9, A ? P 19, Br. ?\*

HABIT.—*Sea of Pinang.*

TOTAL LENGTH : 6 inch.

All the spines are compressed with the anterior margin convex, sharp and continued over the anterior, horizontally forwards directed root. The two posterior roots are placed at nearly right angles with the anterior. The roots are generally longer than the spines of which the longest appear on the sides of the back and body. Two longitudinal series of spines of the mesial line of the back, and three of the abdomen are shorter than the rest. There are three spines above the upper half of the orbit, three at the lower, and one at the angle of the mouth. The throat is naked with a single small bony protuberance beneath the symphysis of the lower jaw. Between the eyes appear three spines, viz. a central and the anterior one of the three supraorbital ; between the pectorals across the back appear four spines. The upper part of the back carries four longitudinal series, viz. two central, each of eight, both terminating with an odd spine at a little distance in front of the dorsal fin, and two lateral series each of five spines, of which the anterior commences a little behind the pectoral fins, the posterior is situated between the dorsal and the caudal. This fish is of very rare occurrence at Pinang. The only one observed was a specimen which on account of its rarity had been kept preserved for several years, and was thus rendered unserviceable for more minute examination.

GEN. TETRODON, *Linné*, 1766.

The jaws divided in the centre by a suture, so as to present the appearance of four teeth : two above and two beneath ; the skin armed with small, slightly projecting spines ; ventrals none.

\* In *Mém. du Mus.* IV, Cuvier gives six, in *Règne Animal* five branchiostegous rays.



I.\* *Species with short head, capable of inflating themselves so as to attain a globular form.*

*Entire body rough.*

*A. Immaculate.*

**TETRODON IMMACULATUS, Lacépède.**

Lacépède, I. XXIV. 1.

Russell, XXVI. Kappa.

*Tetrodon immaculatus*, Cuv. R. A. II. 368 (\*).

*Young.* Head above and back pale greyish olive, lighter on the sides of the head and upper part of the body; abdomen pale yellow ochre; axilla and the smooth spot inside the pectorals blackish; the whole body minutely dotted with brown; spines white, those of the back with black points; pectorals, anal and dorsal pale transparent olive, base of the latter blackish; caudal pale brownish with single indistinct whitish spots; upper, lower and posterior margin black. Iris olive.

D 10, C 9½, A 9, P 17, Br. V.

HABIT.—*Sea of Pinang.*

Madras.

TOTAL LENGTH: 3½ inch.

The length of the head, measured to the margin of the gill-opening, is contained 4½ times in the total. The eye, bordering on the profile, is situated a little nearer the gill-opening than the muzzle; the horizontal diameter is ½ of the head; the distance across the forehead is a little less than 2 diameters. The double, contiguous nostrils are situated in front of the eyes; each aperture is pierced through a small papilla, and both appear like a minute simple tentacle. The jaws are nearly equal, the four teeth normal; the tongue is globular, fleshy, tied to the floor of the mouth. The dorsal is fan-shaped; the first, undivided, ray is situated a little behind the commencement of the posterior third of the back, the caudal not included; the extent of the base is ½ of the head, of which the longest ray is ¼. The first anal ray is situated behind the dorsal, at the commencement of the posterior fifth of the body; in shape and dimensions it resembles the dorsal. The caudal is broad

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\* Cuvier: *Règne Animal*, II. 368 (\*).

with the posterior margin rounded; its length equals the head. The pectorals are broad and rounded,  $\frac{1}{3}$  of the length of the head. The lips, the throat, the space in front of the eyes, and that covered by the pectorals, and the tail from midway behind the dorsal, obliquely down a little in front of the anal, are all naked and smooth. The rest of the body is covered with crowded fine hair-like spines. A solitary young individual was observed at Pinang in September 1844. Russell observed but the mutilated specimen, which he described and figured.

B. *With black spots.*

TETRODON SIMULANS, Cantor.

Head above and back light yellowish or greenish olive, paler on the upper half of the sides of head and body; head, back and sides with numerous rounded, irregular or confluent spots, blackish brown or olive or black; throat and abdomen white, sparingly dotted with brown; spines white, fins pale olive, transparent, minutely dotted with black; anterior half of caudal with three or four more or less distinct backwards arched blackish bands, posterior half blackish. Iris bright yellow dotted with black.

D 12 or 13, C  $8\frac{1}{2}$ , A 10 or 11, P 19 or 21, Br. V.

HABIT.—*Sea and estuaries of Pinang, Malayan Peninsula, Singapore.*

TOTAL LENGTH: 1 foot.

The length of the head is contained  $3\frac{1}{2}$  times in the total. The eye is situated in the middle of the head, bordering on the profile; the horizontal diameter is contained  $5\frac{1}{2}$  times in the length of the head; the distance between the anterior angles of the orbits is 2 diameters; between the posterior angles  $2\frac{1}{2}$  such. There are no nostrils, but close in front of the anterior angle of the orbit appears a flattened simple tentacle. The upper jaw slightly projects beyond the lower; the tongue resembles that of *T. immaculatus*. The rounded dorsal fin occupies the commencement of the posterior fourth of the back; the three first rays are undivided; the fifth and sixth are the longest,  $\frac{1}{3}$  of the head, and equal the extent of the base. The anal is placed opposite the dorsal, which it resembles, but the extent of the base is a little shorter, and but the two first rays are divided. The caudal is broad, with the upper, lower and posterior

margins convex; its length is  $\frac{3}{4}$  of the head. The pectorals are broad, rounded; their length equals that of the dorsal. There is no lateral line. The spines are rather long, fine and somewhat distant; above they extend from between the eyes to near the dorsal; beneath from behind the throat to near the anus, which is situated a little in front of the anal. Young individuals of this species are at all seasons excessively numerous on the Malayan coasts. In general form and in distribution of colours it bears a striking resemblance to *T. fluviatilis*, Buchanan Hamilton,\* which latter differs in having distinct simple nostrils, in number of fin rays and other characters. The present belongs to the Sub-Gen. *Arothron*, Müller.†

*C. With black bands.*

**TETRODON CARDUUS, Cantor.**

Head above and back dark yellow ochre with a number of longitudinal, slightly serpentine black lines continued to the caudal; sides of the head pale ochre with irregular black spots; sides of the body pale lilac whitish with a few distant black spots, disposed so as to form 4 or 5 vertical series; abdomen very pale ochre; dorsal and ventral, pale transparent olive, minutely dotted with black; caudal rays reddish yellow, membrane whitish dotted with black, and with vermicular black spots; pectorals pale yellow, with a blackish narrow band along the base. Iris orange dotted with black.

D 11, C  $9\frac{1}{2}$ , A 10, P 17, Br. V.

**HABIT.**—*Sea of Pinang.*

**TOTAL LENGTH:** 6 inch.

The length of the head is contained  $3\frac{1}{2}$  times in the total. The eye is situated nearly in the centre of the length of the head, bordering upon the profile; the horizontal diameter is  $\frac{1}{4}$  of the head; the distance between the anterior angle of the orbits is nearly three diameters; between the posterior four. No nostrils appear, but their place is supplied by two small black tentacles, the one close above the other. The jaws are nearly

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\* *Fishes of the Ganges* 6,361. Pl. XXX. Fig. 1.—*T. fluviatilis*, Cuv. R. A. II. 368 (¹).

† *AROTHRON*, Müller: "On each side a solid tentacle containing the large olfactorian nerve; an annular muscle round the eye, and a kind of eyelid." (*Abb. Berlin. Akad.* 1839, 252 (¹). Berlin 1841.)

equal, the teeth and tongue normal. The dorsal occupies the commencement of the posterior fifth of the back; it is fan-shaped, with the first ray undivided; the longest rays are  $\frac{1}{2}$  of the head, or twice the extent of the base of the fin. The posterior margin of the caudal is convex; the longest rays are  $\frac{1}{2}$  of the head. The anal resembles the dorsal; it commences, nearly opposite the middle of the distance between the dorsal and the caudal. The pectorals are rounded, their length equals that of the dorsal. The spines are rather long, very fine, hair-like and crowded. On the back they commence from between the nasal tentacula and extend to the caudal, in front of the base of which there is but a small naked space. The lips, the chin and the space inside the pectorals are also spineless. A single individual was observed at Pinang in December 1842. This species is nearly allied to *T. virgatus*, Richardson, (*Zool. Erebus and Terror*, 62, Pl. XXXIX. Fig. 8-9,) from which it differs in the dorsal being situated farther back; in the relative position of the latter fin and the anal, and in the greater number of black lines of the back. In the present the latter are twelve; in *T. virgatus* six. It is also allied to *T. meleagris*, Solander.\*

#### D. With pale spots.

#### TETRODON TESTUDINEUS, Linné.

*Tetrodon testudineus*, Linné: *Amoen. Acad.* I. 309, Tab. 14, Fig. 3.

*Tetrodon testudineus*, Linné, *Syst.* 1444.

*Tetrodon testudineus*, Bloch. Tab. 139.

*Tetrodon testudineus*, Shaw, V. 444, Pl. 178.

*Tetrodon testudineus*, Cuvier, R. A. II. 368 (!).

*Tetrodon testudineus*, Swainson, II. 328.

*Young.* Head above, back and upper part of the sides reddish brown with numerous rounded and elongated milk-white spots, minutely dotted with brown; rest of the sides and abdomen reddish yellow with a number of brown parallel bands, downwards arched and increasing in length, interrupted, or two joined, towards the tail; caudal dark brown with numerous whitish spots; rest of the fins yellowish, transparent, blackish at the base. Iris reddish yellow dotted with black.

D 10, C  $8\frac{1}{2}$ , A 10, P 15, Br. V.

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\* SYN. Lacép. I. 505.—Bl. Schn. 507.—*T. meleagris*, Richardson: *Ichth. Sulph.* 122, Pl. 57 Fig. 1-3, and *Voy. Samarang* p. 19.

**HABIT.**—*Sea of Pinang.*

*Indian Ocean.*

**TOTAL LENGTH :**  $3\frac{1}{2}$  inch.

The length of the head is contained  $3\frac{1}{2}$  times in the total. The eye, bordering on the profile, is a little nearer the muzzle than the gill-opening ; its greater diameter, rising obliquely backwards, is  $\frac{1}{2}$  of the length of the head ; the distance between the anterior angles is two such diameters ; three between the posterior. The nostrils have two small apertures, between which rises a small tentacle. The teeth and tongue are normal. The rounded dorsal is situated between the penultimate and posterior fourths of the back ; the two first rays are undivided, the fifth and sixth, the longest, are contained  $2\frac{1}{2}$  times in the length of the head, and they equal the extent of the base. The caudal is broad, with the posterior margin rounded ; its length  $\frac{2}{3}$  of the head. The first undivided anal ray commences opposite the termination of the dorsal fin, which it resembles. The pectorals are broad, rounded ; their length is a little less than that of the dorsal. The spines commence immediately behind the upper lip, and terminate a little behind the dorsal, and immediately behind the anal, leaving the tail naked. In form they resemble those of *T. carduus*. Single individuals, none of which exceeded the length stated, were observed at all seasons at Pinang.

**TETRODON BONDARUS, Cantor.**

*Russell, XXVII. Bondaroo Kappa.*

*Young.* Head above, lips, lower half of the sides and abdomen very pale yellowish olive, minutely dotted with brown ; back blackish olive ; upper half of the sides brownish olive, with numerous rounded brownish-white spots, many of which are surrounded by a broad black ring, forming a kind of interrupted net-work ; inside and behind the pectorals a large black spot, in which a bright yellow oval half-ring, cut by the axilla ; a little in front of the pectorals a bright yellow oval spot, half hid by the black gill-cover ; on the sides of the head a number of small brownish white spots, and a large black spot like an erect horse-shoe ; on the throat a round black spot from whence a widely arched black line ascends to each pectoral ; dorsal, anal and pectorals pale brownish olive, minutely dotted with black ; caudal darker brownish olive with

numerous indistinct whitish spots, and with a broad black band along the posterior margin. Iris bright yellow minutely dotted with black.

D 10, C  $9\frac{1}{2}$ , A 9, P 18, Br. V.

HABIT.—*Sea of Pinang.*

Vizagapatam.

The length of the head is contained  $4\frac{1}{2}$  times in the total. The eye borders on the profile and occupies nearly the centre of the distance between the muzzle and the gill-opening, but it is on a level above the latter and the pectorals; the greatest diameter, ascending obliquely backwards, is  $\frac{1}{2}$  of the length of the head; the distance between the anterior angles of the orbit is  $1\frac{1}{2}$  such diameters; between the posterior angles it is two such. There are no nostrils, but in their place appear two lanceolate black tentacula, of which the upper one is the longer, both joined at the base. The teeth and tongue are normal. All the fins are rounded. The first dorsal ray is situated a little behind the commencement of the posterior third of the body, the caudal not included; the two first rays are undivided; the fifth and sixth, the longest, are contained  $2\frac{1}{2}$  times in the head; the extent is  $\frac{1}{2}$  less; the distance from the caudal is contained  $5\frac{1}{2}$  times in the total length. The anal\* is situated behind the dorsal, which it resembles; its distance from the caudal slightly exceeds  $\frac{1}{2}$  of the total. The length of the caudal is  $\frac{3}{4}$  of the head; that of the pectorals is a little less than the dorsal. The spines in form and position resemble those of *T. testudineus*, but above they commence from between the eyes. A single young individual was observed at Pinang in May 1844.

*Sides smooth without spines.*

#### TETRODON LUNARIS, Cuvier.

Russell, XXIX. Kappa Koorawah.

*Tetrodon lunaris*, Cuv. R. A. Ed. 1, II. 148 (').

*Tetrodon tepa*, Buchanan Hamilton, 10, and 362.

(Icon.) *Tetrodon leiopleura*, Gray: Ill. Ind. Zool. I. Pl. 87, Fig. 2.  
(Young.)

*Tetrodon lunaris*, Rüppell: Neue Wirbelth. Fische, 59.

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\* The position of this fin is correctly described by Russell, but his figure represents it in a much too advanced position.

*Physogaster*\* *lunaris*, Müller: Abh. Berl. Akad. 1839,  
252 (').

*Tetrodon lunaris*, Temm. et Schl. Fauna Jap. Pisc. CXXII.

Fig. 1.

Head above and back green olive with a mixture of brownish, lighter on the upper third of the sides; rest of the latter to the abdominal keel, sides of the head and opercles white satin with a broad longitudinal band of shining yellow brass from the eye to the caudal; abdomen milk-white; fins yellow; posterior caudal margin blackish. Iris bright yellow brass-coloured, blackish towards the orbit.

D 12, 13 or 14, C 8½, A 11 or 12, P 16, Br. V.

HABIT.—*Sea and estuaries of Malayan Peninsula and Islands.*

Coromandel, Bay of Bengal, Gangetic estuaries, Suez,  
Japan.

TOTAL LENGTH: 1 foot.

The length of the head slightly exceeds  $\frac{1}{4}$  of the total. The eye, bordering on the profile, is situated nearer the gill-opening than the muzzle, above the level of the former and of the pectorals; its longest diameter, ascending obliquely backwards, is  $\frac{1}{3}$  of the length of the head. The distance between the eyes equals the diameter. The oval nasal cavity is situated midway between the eyes and the muzzle; each contains two small papillular apertures. The teeth and tongue are normal. The thread-like lateral line commences beneath the posterior part of the nasal oval cavity, descends a short distance nearly vertically, then proceeds horizontally over the upper part of the cheek; opposite the posterior part of the orbit it ascends obliquely to the upper margin of the opercle, between which and the posterior angle of the orbit it gives off a branch which describes an arch over the supraorbital margin. From the upper margin of the opercle the lateral line follows the profile of the back, a little above the lower margin of the spiny portion to a little in front of the dorsal, when it descends obliquely and then continues nearly in the middle of the tail, nearer, however, the soft abdominal keel than the profile of the

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\* *PHYSOGASTER*, Müller, 1841. "With a hollow papilla in the nasal cavity, not, however, continued in a tube; lateral margin of abdomen raised into a soft keel from the throat to the tail, corresponding to a second, superior keel on the sides of the tail."—*Physogaster* is inadmissible, as it has been applied by Latreille in 1833 to a genus of *Coleoptera*.

back, and terminates at the root of the caudal. The soft abdominal keel commences from the throat and proceeds straight along the upper margin of the spiny portion of the abdomen to the lower part of the root of the caudal. The dorsal is situated a little behind the commencement of the posterior third of the back; the two first rays are undivided; the second, the longest of all, is  $\frac{1}{2}$  the length of the head; the posterior margin of the fin is nearly vertical; the extent of the base is  $\frac{1}{2}$  of the length of the second ray; the distance from the caudal is contained  $4\frac{1}{2}$  times in the total length. The first and only undivided anal ray is placed opposite the posterior half of the dorsal, which it resembles, but the extent is a little less; the distance from the caudal is contained  $4\frac{1}{2}$  times in the total length. The upper and lower caudal margins are arched, but the former is a little longer than the latter; the third, or first divided, ray from above is the longest,  $\frac{1}{2}$  of the length of the head; the posterior margin is concave or crescent-shaped. The pectorals are broad, their posterior margin obliquely truncated; the second upper ray is the longest,  $\frac{1}{2}$  of the length of the head. The spines are short, strong, crowded and deeply imbedded in the integuments. Above they commence from the space between the nostrils and terminate a little in front of the dorsal; laterally they extend but very little below the lateral line; on the abdomen they commence from a little behind the throat, are bounded above by the soft keel, and terminate with the anterior half of the body. In the figure of M. M. Temminck and Schlegel in *Fauna Japonica* the spines are represented more distant than they are in the individuals of the Malayan Seas and of the Bay of Bengal, and they appear above to commence from the occiput. In both the latter localities the species is at all seasons very numerous.

**TETRODON OBLONGUS, Bloch.**

*Tetrodon oblongus*, Bloch, Tab. 146.

*Tetrodon oblongus*, Shaw, V. 446.

*Tetrodon oblongus*, Cuv. R. A. Ed. I. 148 (').

*Physogaster oblongus*, Müller, l. c.

*Young.* Head above dark brownish olive with numerous rounded brownish white spots; back and upper third of the sides brownish white, minutely dotted with reddish brown, and with upwards of 11 short dark brownish vertical bands, confluent on the back, and not



extending beyond the upper third of the sides; rest of the latter and those of the head pale yellowish buff dotted with reddish brown; abdomen milkwhite; fins transparent yellowish buff, minutely and sparingly dotted with black.

D 13, C  $8\frac{1}{2}$ , A 10, P 17, Br. V.

HABIT.—*Sea of Pinang.*

Indian Ocean.

TOTAL LENGTH:  $5\frac{1}{4}$  inch.

The length of the head is a little less than  $\frac{1}{4}$  of the total. The eye, bordering on the profile, is situated a little nearer the gill-opening than the muzzle, above the level of the latter and the pectorals; its horizontal diameter is  $\frac{1}{4}$  of the head; the distance across the forehead two such diameters. Each nostril has two small papillular apertures. The teeth and tongue are normal. The posterior part of the opercle is naked terminating below in a sharp, downwards pointed angle. The elongated rounded dorsal is situated a little behind the commencement of the posterior third of the back; the anterior four rays are undivided; the sixth and seventh, the longest, are  $\frac{1}{2}$  of the length of the head, of which the extent of the base is  $\frac{1}{4}$ ; the distance from the caudal is a little less than  $\frac{1}{3}$  of the total length. The anal commences opposite the third dorsal ray; the three anterior rays are undivided; the sixth, the longest, equals the corresponding dorsal; the posterior margin is vertical; the extent of the base is a little less than that of the dorsal; the distance from the caudal equals that of the latter. All three margins of the caudal are slightly arched; the length of the fin is about  $\frac{1}{4}$  of that of the head. The pectorals are broad; the posterior margin is a little rounded; the first upper ray, the longest, is contained  $2\frac{1}{2}$  times in the head. The very fine hair-like lateral line appears to commence from behind the occiput; at first it follows closely the profile of the back, when it descends obliquely to opposite the last dorsal ray, and then continues in the middle of the tail to the caudal. The abdominal keel is so little raised as scarcely to deserve the name; it commences behind the throat and rises in a low arch towards the pectoral fin, from whence it obliquely descends to a little in front of the anal, and follows the profile of the abdomen to the lower part of the root of the caudal. The spines are short and not very strong, but crowded; above they commence from between the nostrils and terminate a little in front of the dorsal; the

back, and terminates at the root of the caudal. The soft abdominal keel commences from the throat and proceeds straight along the upper margin of the spiny portion of the abdomen to the lower part of the root of the caudal. The dorsal is situated a little behind the commencement of the posterior third of the back; the two first rays are undivided; the second, the longest of all, is  $\frac{1}{2}$  the length of the head; the posterior margin of the fin is nearly vertical; the extent of the base is  $\frac{1}{2}$  of the length of the second ray; the distance from the caudal is contained  $4\frac{1}{2}$  times in the total length. The first and only undivided anal ray is placed opposite the posterior half of the dorsal, which it resembles, but the extent is a little less; the distance from the caudal is contained  $4\frac{1}{2}$  times in the total length. The upper and lower caudal margins are arched, but the former is a little longer than the latter; the third, or first divided, ray from above is the longest,  $\frac{1}{2}$  of the length of the head; the posterior margin is concave or crescent-shaped. The pectorals are broad, their posterior margin obliquely truncated; the second upper ray is the longest,  $\frac{1}{2}$  of the length of the head. The spines are short, strong, crowded and deeply imbedded in the integuments. Above they commence from the space between the nostrils and terminate a little in front of the dorsal; laterally they extend but very little below the lateral line; on the abdomen they commence from a little behind the throat, are bounded above by the soft keel, and terminate with the anterior half of the body. In the figure of M. M. Temminck and Schlegel in *Fauna Japonica* the spines are represented more distant than they are in the individuals of the Malayan Seas and of the Bay of Bengal, and they appear above to commence from the occiput. In both the latter localities the species is at all seasons very numerous.

**TETRODON OBLONGUS, Bloch.**

*Tetrodon oblongus*, Bloch, Tab. 146.

*Tetrodon oblongus*, Shaw, V. 446.

*Tetrodon oblongus*, Cuv. R. A. Ed. I. 148 (').

*Physogaster oblongus*, Müller, l. c.

*Young.* Head above dark brownish olive with numerous rounded brownish white spots; back and upper third of the sides brownish white, minutely dotted with reddish brown, and with upwards of 11 short dark brownish vertical bands, confluent on the back, and not

extending beyond the upper third of the sides; rest of the latter and those of the head pale yellowish buff dotted with reddish brown; abdomen milkwhite; fins transparent yellowish buff, minutely and sparingly dotted with black.

D 13, C 8 $\frac{3}{4}$ , A 10, P 17, Br. V.

HABIT.—*Sea of Pinang.*

Indian Ocean.

TOTAL LENGTH: 5 $\frac{1}{4}$  inch.

The length of the head is a little less than  $\frac{1}{4}$  of the total. The eye, bordering on the profile, is situated a little nearer the gill-opening than the muzzle, above the level of the latter and the pectorals; its horizontal diameter is  $\frac{1}{4}$  of the head; the distance across the forehead two such diameters. Each nostril has two small papillular apertures. The teeth and tongue are normal. The posterior part of the opercle is naked terminating below in a sharp, downwards pointed angle. The elongated rounded dorsal is situated a little behind the commencement of the posterior third of the back; the anterior four rays are undivided; the sixth and seventh, the longest, are  $\frac{1}{4}$  of the length of the head, of which the extent of the base is  $\frac{1}{4}$ ; the distance from the caudal is a little less than  $\frac{1}{4}$  of the total length. The anal commences opposite the third dorsal ray; the three anterior rays are undivided; the sixth, the longest, equals the corresponding dorsal; the posterior margin is vertical; the extent of the base is a little less than that of the dorsal; the distance from the caudal equals that of the latter. All three margins of the caudal are slightly arched; the length of the fin is about  $\frac{1}{4}$  of that of the head. The pectorals are broad; the posterior margin is a little rounded; the first upper ray, the longest, is contained 2 $\frac{1}{4}$  times in the head. The very fine hair-like lateral line appears to commence from behind the occiput; at first it follows closely the profile of the back, when it descends obliquely to opposite the last dorsal ray, and then continues in the middle of the tail to the caudal. The abdominal keel is so little raised as scarcely to deserve the name; it commences behind the throat and rises in a low arch towards the pectoral fin, from whence it obliquely descends to a little in front of the anal, and follows the profile of the abdomen to the lower part of the root of the caudal. The spines are short and not very strong, but crowded; above they commence from between the nostrils and terminate a little in front of the dorsal; the

opercles, except the posterior part of the opercle, and the abdomen to a little in front of the anus, are spinous ; but the cheeks, lips, throat and the posterior part of the body, from between the anus and dorsal, are naked. A single individual was observed at Pinang in January 1844.

**TETRODON DISSUTIDENS, Cantor.**

Russell, XXV. II. Kappa, (*Young.*)

Crown and sides of the head and back satin reddish brown with purple reflections, lighter on the sides of the body, minutely dotted with reddish brown ; back and sides with numerous large rounded spots, dark brownish or olive white ; three or four blackish brown vertical bands, indistinct and spotted like the rest, viz. one between the eyes, a second behind the pectorals, surrounding the gill-opening ; a third, not constant, between the latter and the dorsal ; a fourth from the base of the dorsal ; abdomen milk-white ; the indistinct abdominal keel in some individuals light yellow ; dorsal, pectorals and caudal transparent whitish olive minutely dotted with brown ; posterior half of the caudal blackish ; anal whitish. Iris bright yellow, minutely dotted with black towards the orbital margin.

D 10, C  $8\frac{1}{2}$ , A 8, P 16, Br. V.

HABIT.—*Sea of Pinang.*

Coromandel.

TOTAL LENGTH : 7 inch.

The head is elongated, contained  $3\frac{1}{2}$  times in the total length. The eye is situated a little nearer the muzzle than the gill-opening, with which the lower margin of the orbit is nearly on a level ; the horizontal diameter of the eye is  $\frac{1}{4}$  of the length of the head ; the distance between the anterior angle of the orbits equals two such diameters ; between the posterior angles it is  $2\frac{1}{4}$ . A little in front of the anterior angle of the orbit appears a single small aperture, with a small simple tentacle at the anterior margin. The suture of the two upper teeth is not closely fitting as in the other species, but a little open so as to display 6 or 7 small denticulations on the corresponding margin of each tooth ; otherwise the teeth and tongue are normal. The rounded dorsal is situated a little behind the commencement of the posterior third of the body, the caudal not included ; the two first rays are undivided ; the third and fourth, the longest, are contained  $2\frac{1}{2}$  times in the length of the head, of

which the extent of the base but slightly exceeds  $\frac{1}{4}$ ; the distance from the caudal is  $\frac{1}{4}$  of the total length. The anal commences opposite the posterior half of the dorsal, which it resembles in form and length, but the extent of the base is a little shorter; the distance from the caudal is contained  $5\frac{1}{2}$  times in the total length. The three caudal margins are slightly convex; the length of the fin is  $\frac{2}{3}$  of the head. The pectorals are broad, slightly rounded, the lower rays are but little shorter than the upper which are contained  $2\frac{2}{3}$  times in the length of the head. The spines are rather short and fine, and disposed on two separate spots. Above they cover a narrow oval spot from behind the occiput to opposite the termination of the pectorals; laterally they extend to within a vertical distance from the gill-opening of  $\frac{1}{4}$  of the length of the head; they are very distant and so deeply imbedded, as easily to escape observation. Below they commence on a level with the angle of the mouth, but opposite the posterior margin of the orbit, their anterior margin is deeply excavated; the lateral margin describes an arch, which keeps a little beneath the lower part of the root of the pectoral, and terminates behind at some distance in front of the anal, which is situated nearly opposite the first dorsal ray. The spines of the anterior half are crowded; those of the posterior distant. Along the arched lateral margin of the spinous spot appears an indistinct abdominal soft keel, which afterwards continues straight to the lower part of the root of the caudal. The other parts of the body are naked. No lateral line is visible. Smaller individuals of this species are at Pinang very numerous at all seasons.

**TETRODON NARITUS, Richardson.**

Plate X. (*Young*).

*Tetrodon naritus*, Richardson: Ichthyol. Voy. Samarang, 18, Pl. VIII. Figs. 1-3.

*Young*. Head and body yellow brass-coloured; head above, back and upper half of the sides minutely dotted with black, so closely as to appear blackish; fins bright gamboge; dorsal, caudal and anal each with a single large irregular black spot, occupying the greater part of these fins, but leaving open a narrow space along the base; lips whitish lilac. Iris shining brass-coloured.

*Adult.* Head and body burnished reddish golden, or bronze; back and upper half of the sides paler blackish than in the young; as also the spots of the fins. Iris coloured like the body, bluish black towards the orbit.

D 35 or 36, C 9 $\frac{1}{2}$ , A 28 or 29, P 17, Br. V.

HABIT.—*Sea of Pinang.*

River Sarawak (Borneo).

TOTAL LENGTH: 10 inch.

The general form is elongated pyriform, laterally compressed. The profile rises obliquely to between the eyes, from which it is nearly straight to the dorsal, when it greatly slopes towards the caudal. The abdominal profile is much more bulging; from the throat to opposite the pectorals it descends obliquely; from thence it rapidly ascends to the caudal. The cranial bones are soldered together and form a smooth helmet, arched from side to side, in shape somewhat resembling that of *Plotosus albilabris*, Cuv. and Val. The anterior extremity of the helmet is constricted and divided in two diverging narrow points formed by the anterior frontal bones, which behind border the depression containing the nostril. From thence the lateral margin is convex forming the supraorbital margin, when it deviates obliquely inwards and backwards, and terminates on the side of the occiput in a broad triangular point. From the centre of the posterior margin projects along the back a narrow occipital crest. The outline of the helmet resembles a broad arrow-head with bifid point. The distance from the muzzle to the point of the occipital crest equals that to the gill-opening, which is contained 3 $\frac{1}{2}$  times in the total length. Measured from the centre between the anterior two points, the length of the helmet is  $\frac{1}{2}$  of the total, and of this distance the occipital crest itself is  $\frac{1}{4}$ . The eye, bordering on the cranial helmet and on a level with the upper part of the gill-opening, is situated in front of the centre of the distance between the muzzle and the gill-opening; the horizontal diameter is  $\frac{1}{4}$  of the length of the head. The distance between the anterior orbital angles across the helmet is 1 $\frac{1}{2}$ , between the posterior 2 $\frac{1}{2}$  diameter. In front of the anterior orbital angle appears a single large nostril, which is oval, with a lax membrane, notched at the anterior part. The jaws are nearly equal; the teeth and the tongue normal. The form of the dorsal is broad triangular, with the posterior part truncated a little

rounded; the first ray is situated nearly in the centre between the muzzle and the caudal; the first five rays are undivided, and with the succeeding ones gradually increase in length to the 14th and 15th, which are the longest,  $\frac{1}{2}$  the length of the head; the extent of the base is contained  $3\frac{1}{4}$  times in the total length, of which latter the distance from the caudal is  $\frac{1}{4}$ . The anal commences opposite the second third of the dorsal, which it resembles in form; the two first rays are undivided; the 10th and 11th rays are the longest, a little shorter than the 14th and 15th dorsal. The extent of the base is a little less than the length of the head; the fin terminates a little behind the dorsal. The three margins of the caudal are a little convex; the length slightly exceeds  $\frac{1}{2}$  of the head. The pectorals are broad oval; their length is about  $\frac{1}{3}$  of the head. The spines are strong, distant, upwards pointed and scarcely longer than their two oblique roots. They are placed so as to form a broad belt, the superior margins of which commence behind the orbit, and proceed straight to a little behind the pectorals; from thence the posterior margin encircles the abdomen to within a short distance of the anus, which is situated opposite the commencement of the dorsal; the anterior margin follows the posterior part of the cheek and then proceeds obliquely forwards behind the throat. The rest of the body is perfectly smooth, without abdominal keel. During life the lateral line is very indistinct. On the vertex and the cheeks appear several anastomosing lines, which on each side continue in three undulating lines: one close to the back, a second in the middle, and a third near the abdomen; all three terminate at the root of the caudal. Three individuals, varying from  $4\frac{1}{2}$  to 10 inches in length, were observed at Pinang in February and November 1844, and in July 1845. The enlargement of the upper and under interspinous bones of the tail, described by Richardson, is no constant character. It existed in none of those examined at Pinang, but one of them had an isolated osseous tubercle in front of the anal, another had a similar in the middle of the left side. Like *Harpochirus punctatus* and *Platax arthriticus* the present species appears to have a tendency to hypertrophy of the bones.

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All the preceding species of *Tetrodon* are capable of inflating the abdomen, and in this state, when taken or handled, they emit a grating sound. They are also remarkable for tenacity of life, which they are

capable of sustaining for several hours after having been taken out of their element. They have a peculiar disagreeable odour, resembling that of *Gobioidæ*, which continues in specimens for several years preserved in spirits of wine. In the Malayan countries they are considered highly poisonous, and are even objected to as manure.

## ORDO LOPHOBRANCHII.

### FAM. SYNGNATHOIDÆ.

GEN. SYNGNATHUS, *Artedi*, 1738, (*Cuvier*, 1817.)

Snout tubular, formed by the prolongation of the ethmoid, vomer, tympanals, pre-opercles, sub-opercles, &c., and terminated by an ordinary mouth, vertically cleft on the extremity of the snout; respiratory aperture near the nape; ventrals none; body elongated, thin, differing but little in diameter throughout its whole length.

*A. Without anal.*

SYNGNATHUS PENICILLUS, Cantor.

Head and body pale greenish brown, minutely dotted with brown on the sides; in the middle of each ring of the body a horizontal, oval, cream-coloured spot, beneath edged with black; on each side of the abdomen an indistinct cream-coloured dot; pectorals, dorsal and the membranous sac hyaline, the latter minutely dotted with pale brown; caudal rays blackish, with hyaline points. Iris and the circular pupil black.

D 22, C 6, P 18. Br. ? Rings of the body 18, of the tail 35.

TOTAL LENGTH:  $3\frac{1}{2}$  inch.

HABIT.—*Sea of Pinang.*

The length of the head is contained  $4\frac{1}{2}$  times in the total; the distance from the posterior margin of the orbit to the gill-opening is  $\frac{2}{3}$  of the length of the head; that from the symphysis of the lower jaw to the anterior margin of the orbit is  $\frac{2}{3}$  of the length of the head; the diameter of the orbit is  $\frac{1}{10}$  of the head; the distance between the eyes is less than their diameter. From the posterior margin of the orbit proceeds a sharp raised line a little downwards to the posterior margin of the opercle; from above and below radiate backwards a number of very fine lines. The body and tail, as far as the membranous sac



extends, are hexagonal, the greatest vertical diameter is  $\frac{1}{2}$  of the length of the head; the rest of the tail is quadrangular, tapering, but not terminating in a point. The anus is situated as much as the length of the snout in front of the middle of the total length. The membranous sac is attached to the abdominal surface of the 15 anterior caudal rings; it forms a segment of a circle, its greatest depth not exceeding the diameter of the eye. The dorsal commences a little behind the anus; the length of the rays is  $\frac{1}{2}$ , the extent of the base  $\frac{2}{3}$  of the length of the head. The length of the pectorals equals that of the dorsal. The posterior surface of the last caudal ring carries 6 very minute branched rays, which are placed horizontally, at a distance from each other: one at each of the four angles, and one from the middle of the lateral margin. This distribution gives the caudal the appearance of a small brush. A solitary individual was observed at Pinang in July 1845. This species is readily distinguished from *S. spicifer*, Rüppell\* and from *S. gooraphoo*† by the comparatively longer head.

*B. Without caudal.*

**SYNGNATHUS BIACULEATUS, Bloch.**

*Syngnathus biaculeatus*, Bloch. Tab. 121, Fig. 1, 2.

*Syngnathus biaculeatus*, Bloch-Schneider, 515, Tab. 1.

*Syngnathus biaculeatus*, Shaw, V. 453.

*Syngnathus biaculeatus*, Richardson, Report, 1845, 202.

Head and body pale seagreen; abdomen pale ochre or buff; in the middle of the side of the rings of the body a large vertically oval spot, lighter than the general colour, edged with very pale vermilion; in some a few black dots, scattered along the sides of the abdomen; fins hyaline. Iris pale silvery green, dotted with brown.

D 43 to 45, A 3, 4 or 5, P 21 or 22, Br. IV? Rings of the body 18, of the tail about 55.

TOTAL LENGTH:  $9\frac{1}{2}$  inch.

HABIT.—*Sea of Pinang, Singapore, Malayan Peninsula.*

*China Seas, Philippines.*

The length of the head is contained a little less than  $5\frac{1}{2}$  times in the

\* Neue Wirbelth: Fische, 143. Tab. 33, Fig. 4.

† Russell, 21, No. XXX. *Gooraphoo Subbookoo*, (" *S. typhle*, Lin.")

total; the distance from the posterior margin of the orbit to the gill-opening is nearly  $\frac{1}{4}$  of the head; that from the symphysis of the lower jaw to the anterior margin of the orbit exceeds by  $\frac{1}{2}$  half the length of the head. The diameter of the orbit is  $\frac{1}{7}$  of the length of the head. The distance across the forehead is a little less than one diameter. From the posterior part of the supraorbital margin rises a small, backwards directed thorn, which like the rest of the head is minutely honey-combed. A similar, but smaller thorn appears in the middle of the anterior and posterior margin of the orbit. The opercles are soldered together, and with numerous backwards radiating lines. The occipital crest is surmounted by 3 minute thorns. The body and tail, as far as the dorsal extends, are heptagonal; the rest of the tail is quadrangular, gradually tapering into a point. The greatest vertical diameter, halfway between the head and the dorsal, is about  $\frac{1}{2}$  of the length of the head; the greatest horizontal diameter of the back is contained from  $6\frac{1}{2}$  to 7 times in the length of the head, while that of the abdomen varies from  $2\frac{1}{2}$  to 3 times in the head. The anus is situated as far behind the middle of the total length as  $\frac{2}{3}$  of the length of the snout. The dorsal commences on the 18th ring of the body, a little in front of the anus, and continues on the 10 anterior rings of the tail; the extent of the base is one diameter of the orbit shorter than the head; the dorsal and pectoral rays scarcely exceed  $\frac{2}{3}$  of the diameter of the orbit; the anal rays are about  $\frac{1}{2}$ . Single individuals occur in the Straits of Malacca during all seasons.

GEN. HIPPOCAMPUS, Cuvier, 1817.

Trunk laterally compressed and conspicuously more elevated than the tail; the junctions of the rings are raised into ridges and their salient angles into spines; caudal none.

HIPPOCAMPUS MANNULUS, Cantor.

Plate XI. Fig. 1.

*Young.* Pale greyish brown; sides and abdominal surface of tail pale yellowish.

LENGTH:  $3\frac{1}{2}$  inch.

*Older.* Pale yellow ochre; fins hyaline; dorsal with two longitudinal series of blackish spots. Iris silvery bluish-grey.

LENGTH : 5 inch.

D 19, A 4, P 17, Br. ? Rings of the body 11, of the tail 36.

HABIT.—*Sea of Pinang.*

The length of the head is  $\frac{1}{4}$  of the total ; the distance from the symphysis of the lower jaw to the nostril is  $\frac{1}{2}$  of the length of the head, of which the diameter of the orbit is  $\frac{1}{3}$ . From the middle of the supra-orbital margin rises a small backwards directed spine ; the distance between both is less than the diameter of the orbit. From the posterior margin of the orbit radiate numerous lines over the opercles. The occiput carries a crest, surmounted in front by a tubercle, behind by five minute spines ; at the root of the pectorals, and on each side of the throat appears a small backwards directed spine. The body is heptagonal, its greatest vertical diameter slightly exceeds  $\frac{1}{2}$  of the length of the head ; the tail is quadrangular, tapering into a point. The anus is situated nearly in the middle of the total length, and opposite the middle of the dorsal. The latter occupies the 10th and 11th ring of the body and the first of the tail ; all three rings are arched, so as to appear like a crest from which the dorsal rises. The length of the rays is a little less than two diameters of the orbit ; the extent of the base is  $\frac{2}{3}$  of the length of the head. The pectorals are a little shorter than the dorsal ; the anal is about half the diameter of the orbit. One individual was observed at Pinang in September 1842 ; a second in January 1844.

#### HIPPOCAMPUS COMES, Cantor.

Plate XI. Fig. 2.

Brownish buff ; opercles bluish ; round the orbit a few distant brown dots ; fins hyaline. Iris silvery white with a number of short brownish lines radiating from the pupil.

D 16, A 4, P 17, Br. ? Rings of the body, 11, of the tail, 33.

TOTAL LENGTH : 5 inch.

HABIT.—*Sea of Pinang.*

The length of the head slightly exceeds  $\frac{1}{4}$  of the total ; the distance from the symphysis of the lower jaw to the nostril is  $\frac{1}{2}$  ; the diameter of the orbit is  $\frac{1}{3}$  of the length of the head. All the spines of the salient angles are surmounted by oval or rounded tubercles. On the forehead between the eyes appears a single spine ; on each supraorbital

margin a similar, and between the two a pair of smaller ones ; single ones also appear at the anterior and posterior margin of the orbit, and a pair a little beneath the lower margin. The occipital crest is surmounted by three spines, behind which rise five smaller ones forming a cluster like a coronet. At the root of the pectorals appear two, and a pair on each side of the throat. Over the opercles radiate some fine lines. The body is heptagonal ; its greatest vertical diameter slightly exceeds the length of the snout to the nostrils. The tail is quadrangular, tapering into a point. The anus is situated nearly in the middle of the total length, opposite the posterior third of the dorsal. The latter occupies the 10th and 11th ring of the body and the first caudal ; the length of the rays is  $1\frac{1}{4}$  diameter of the orbit, the extent of the base is contained about  $3\frac{1}{4}$  times in the length of the head. The pectorals are a little shorter than the dorsal, and the anal is the shortest of all. A single individual occurred at Pinang in August 1844.

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## SUBCLASSIS : SELACHII.

## ORDO : PLAGIOSTOMI.

## SUBORDO : SQUALI.

## FAM. SCYLLIOIDÆ.

GEN. SCYLLIUM, (*Cuvier*, 1829,) *Müller und Henle*, 1841.

Anterior dorsal between the ventrals and anal ; posterior between the anal and caudal ; spiracles immediately behind the eyes ; gill-openings equidistant : both posterior ones immediately above the pectorals ; snout short, blunt ; nostrils near the mouth, in some continued in a fissure to the margin of the upper lip ; superior nasal valves covering the nostrils, so as generally to leave but a small rounded aperture at the external margin ; nasal valves either separated by a larger or smaller piece soldered between their centre, or both united ; in some in the middle of the external surface a projection, which occasionally extends beyond the lower margin of the valve ; in others at the inferior margin of the nostril a smaller valve covered by the larger ; mouth arched ; teeth with a central point and one or two on each side ; several species with the ventral fins united over the male appendages ; scales trifid ; ova resembling those of the Rays.

SCYLLIUM MACULATUM, *Müller und Henle*.

*Scyllium marmoratum*, *Bennett* : *Life of Raffles*, 693 ?

(*Icon.*) *Scyllium maculatum*, *Gray* : *Ill. Ind. Zool.* I. Pl. 98, Fig. 1.

*Scyllium maculatum*, *Müller und Henle* : *Plagiostomen* 5, Taf.

*Scyllium maculatum*, *Richardson* : *Report*, 1845, 193.

(*Young male.*) Ground-colour of the back white, of the sides, vertical fins and upper surface of horizontal fins light slate-blue, with numerous confluent rounded spots, of snuff colour, forming a kind of network ; near the apex of the two dorsal-, of the caudal- and anal fins a transversal snuff-coloured band ; abdomen, lower surface of pectorals and ventrals and the male appendages bluish white. Iris silvery slate-blue ; pupil obliquely linear, black.

HABIT.—*Sea of Singapore.*

Indian Ocean, China Sea, Canton.

TOTAL LENGTH : 1 foot 7 inch.

The anterior dorsal is situated midway between the apex of the snout and that of the caudal ; it commences opposite the termination of the ventrals. The posterior dorsal commences at an equal distance from the root of the ventrals and the apex of the caudal. The anal fin commences a little in front of the posterior dorsal, but it terminates before reaching the middle of that fin. The scales are trifold, with a central, flat, pointed keel, and with a minute point on each side. In time the scales become worn and subrhombic.

A single young male was taken at Singapore in May 1840. Each male appendage measured  $2\frac{1}{2}$  inch in length.

GEN. CHILOSCYLLIUM, *Müller und Henle*, 1837.

Snout blunt ; nostrils extending to the mouth ; nasal valves separated, each carrying a filament ; at the external margin of each nostril a considerable hem-like valve, which continues towards the upper fold of the angle of the mouth ; under lip skinny, broad, separated from the throat by a transverse furrow ; mouth slightly arched ; teeth pointed, with one or two smaller points on each side ; spiracles behind and below the eyes ; at the posterior margin of each spiracle a projecting tubercle ; fourth and fifth gill-opening near each other ; dorsal fins placed in front of anal ; the anterior dorsal behind the ventrals ; pectorals and ventrals rounded, as also the anal and caudal ; the anal, without anterior angle, is arched downwards, terminating behind in a point ; lower margin of the caudal convex.

CHILOSCYLLIUM FLAGIOSUM, (Bennett.)

Russell, XVI. Bokee Sorrah (*Young.*)

Russell, Ra Sorrah, page 10 (*Adult.*)

Scyllium freycineti, Quoy et Gaimard. Freyc. 192 ? (*Young ?*)

Scyllium plagiosum, Bennett : Life of Raffles, 693. (*Young.*)

(*Icon.*) Scyllium ornatum, Gray : Ill. Ind. Zool. I. Pl. 98, Fig. 2.  
(*Young.*)

*Chiloscyllium plagiosum*, Müller und Henle, 18 (*Young*.)\*

*Chiloscyllium plagiosum*, Var 1, Müller und Henle, 18.  
(*Young*.)

*Chiloscyllium plagiosum*, Var 2, Müller und Henle, 18.  
(*Young*.)

Russell : p. 10, "Vielleicht eine Varietät," Müller und Henle,  
20. (*Adult*.)

*Chiloscyllium plagiosum*, Richardson : Report, 1845, 194.

Yu tókay of the Malays.

(*Newborn and very young*.) Ground-colour above white or buff, with numerous black transverse bands, preponderating over the ground-colour, which appears on the head and back like transverse buff bands, each with a transversal brown line in the centre. On the sides and fins the ground-colour is reduced to a number of rounded spots, each with a central brown dot. Lower surface of the body and horizontal fins whitish, of the tail pale blackish. Iris black, with a silvery line bordering the black pupil, which is linear and ascending obliquely backwards. **TOTAL LENGTH** : 4 to 6½ inch.

(*Older*.) Ground-colour ash-grey or isabella coloured, with (11, 12 or 13) pale brownish black transverse bands, broad on the back, narrower on the sides ; the margins darker than the bands, or with distant dark dots ; fins with dark and light spots ; abdominal surface whitish. Iris silvery ash-grey or isabella coloured. (Russell, XVI., *Bokee Sorrah*.—*Scyllium plagiosum*, Bennett.—*Var.* 1, Müller und Henle.)

Or :

Ground-colour ash-grey or nankin yellow with transverse brownish bands edged with black ; within the bands double transverse rows of black dots ; single such between the bands ; on the sides and fins black rings, each with a central black spot. (*Scyllium ornatum*, Gray.—*Var.* 2, Müller und Henle.—*Chiloscyllium plagiosum*, Richardson.—) **TOTAL LENGTH** : 7½ to 14½ inch.

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\* VAR. 3 and VAR. 4, Müller und Henle, are founded upon two unpublished drawings of General Hardwicke. Both have evidently been taken from specimens in the infantile livery, and are no more constant Varieties than VAR. 2 and 3 of M.M. Müller und Henle.

(*Adult.*) Above uniformly ash-coloured or yellowish grey; whitish beneath. Iris silvery, of the ground colour. (*Ra Sorrah*, Russel.—“*Vielleicht eine Varietät*,” Müller und Henle.—)

**TOTAL LENGTH:** 1 ft. 5 inch to 2 ft. 4 inch.

**HABIT.**—*Seas of Pinang, Malayan Peninsula, Singapore.*

Indian Ocean, Seas of China and Japan (Richardson),  
Coasts of Brazil (M. und H.)

The anterior dorsal fin commences immediately above the termination of the ventrals; the posterior dorsal commences as far from the anal as the extent of its own base. In young individuals the scales are narrow lanceolate and keeled; in the adult they are tetragonal or subrhombic, with a polished, not keeled, surface. In the young fish appears along the centre of the back a keel composed of scales larger than the rest; on each side, a little below the central keel appears a similar, which borders the upper third of the side. From the root of the ventral fins to the commencement of the anal appears on each side a third keel, which separates the sides from the abdomen. With age the dorsal keel becomes indistinct, but the others appear to vanish. In young individuals the male appendages do not extend beyond the anterior half of the inner margin of the ventral fins; in mature age their length is double that of the inner margin of the ventrals. The livery of the newborn and mature individuals is as constant as that of the intermediate age is liable to variations. The latter, which are but transitory garbs, have been described as constant and distinct Varieties by M. M. Müller und Henle. Russell is the only observer who described the mature fish. There appears, however, to exist a constant Variety, which is above of a uniform golden bronze colour, paler beneath, with reddish golden fins and with the iris of burnished gold. This Variety is rarely seen in the Straits of Malacca, at Madras,\* and in the Bay of Bengal, as far as the 21st degree. In the Straits of Malacca the species is at all seasons excessively numerous.

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\* Walter Elliot, Esquire, possesses an adult male of this Variety, measuring 2 ft. 2½ inch in length.



## GEN. GINGLYMOSTOMA, Müller und Henle, 1837.

(NEBRIUS,\* Rüppell,) 1837.

Snout blunt; nostrils extending to the mouth, with a short valve at the internal margin, from which proceeds a long cirrus extending to the mouth; a second short valve at the external margin of the nostrils; mouth convex; the folds of the angle of the mouth divided by a deep fissure in an upper and lower fold; the internal extremity of the lower fold separated from the skin of the under lip by a more or less deep, vertical furrow; teeth very numerous, upwards of ten close series, their base rhomboidal, with a central conical apex, with two to four gradually decreasing blunt points on each side; the fifth branchial opening almost hidden in the fourth; both situated above the pectoral fins; spiracles very minute, immediately behind the eyes; anterior dorsal fin opposite the ventrals; posterior dorsal partly in front of, partly opposite the commencement of the anal; the latter fin nearer the caudal than the ventrals, yet not immediately in front of the caudal; the latter with a trace of an inferior lobe; pectoral fins longer than in the rest of *Scyllioidæ*.

## GINGLYMOSTOMA CONCOLOR, (Rüppell.)

*Nebrius concolor*, Rüppell, Neue Wirbelth, 61, Taf. 17, Fig. 1.

Rüppell, Chondropt: 2, Taf. 17, Fig. 2.

*Ginglymostoma concolor*, Müller und Henle, 22, Taf.

*Young.* Light brownish buff. Iris silvery light grey; pupil linear, oblique.

*HABIT.*—*Sea of Pinang.*

Indian Ocean, Massauah (Red Sea).

TOTAL LENGTH: 2 ft. 5 inch.

The anterior dorsal fin commences a little behind the origin of the ventrals, but extends farther back than the termination of the latter. The posterior dorsal commences a little in front of the anal and terminates a little in front of the termination of the latter fin. The scales are broad lanceolate or sub-rhombic with an indistinct central tubercle. The denticulations of the posterior margins are very indistinct, and the scales which are worn down have a polished granular appearance. In the upper jaw appear but three, in the lower four series of teeth, the

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\* Pre-occupied by *Nebria*, Latreille, 1802 (*Coleopt.*)

central apex of which scarcely exceeds the lateral points which gradually decrease. During life the fish carries the tail much more erect than is represented in the figures of M. M. Rüppell, Müller and Henle. The length of the male appendages is less than one-half of the inner margin of the ventral fins. During life this species is distinguished by its beautiful light tint and by its proportions. A solitary young male was taken at Pinang in March 1845. It lived for about two hours in the air. The stomach contained remains of small *Crustacea*. The length of the intestinal canal slightly exceeded  $\frac{1}{2}$  of the total length of the fish.

GEN. *STEGOSTOMA*, Müller und Henle, 1837.

Mouth transverse and narrow ; at the upper and lower jaw the integuments form two flattened rims, which carry the teeth ; the latter exhibit tripartite laminæ ; the centrepiece between the nasal valves is much broader than the valves themselves, and forms a transverse thick rim over the mouth, which above and in front can be covered by this rim. The latter has a rounded free margin in which unite the anterior and posterior surfaces ; the posterior, generally hidden, surface is scaly like the rest. The nasal valves are reduced to skinny hems which laterally enclose the central rim. The nasal valves terminate in a strong cirrus. The lower margin of the nostril has no valve. The folds of the angle of the mouth are short ; the fossets deep. The head is highly arched and rounded. The cleft between the eyelids is very small, transversely oval, with sharp margins. The spiracles are vertical fissures behind the eye. The fifth branchial opening is hid in the fourth ; the third, fourth and fifth appear immediately above the pectoral fins. The anterior dorsal is placed opposite the ventral fins, but extends somewhat in advance ; the posterior dorsal is placed between the ventrals and the anal. The latter is placed immediately in front of the caudal. The latter is nearly throughout of uniform height, with the usual incision before the apex, and it is proportionally very elongated.

*STEGOSTOMA FASCIATUM*, (Bloch.)

Seba : Thes. III. 105, Tab. 34, No. 1.

Gronov. Mus. I. 82, No. 136.—Zoophyl. 34, No. 147.

Le tigre, Brouss. 658.

*Squalus fasciatus*, Bloch. 113.

*Squalus tigrinus*, Linné : Syst. 1493. (*Young*.)

*Squalus longicaudus*, Ibid. 1496.

Zebra Shark, Shaw : Nat. Misc. 434.

*Squale tigre*, Lacépède, I. 249.

*Squalus fasciatus*, Shaw : V. 148. Pl. 148. (*Newborn.*)

*Squalus fasciatus*, Bloch-Schn. 130.

Russell : XVIII. Poollee Makum. (*Newborn.*)

La roussette tigrée, Dict. des Sc. Nat. No. 33, Fig. 2.

*Scyllium heptagonum*, Rüppell : Neue Wirb. 61, Tab. 17, Fig. 1.  
(*Young.*)

*Scyllium heptagonum*, Rüppell : Chondropt. 1. Tab. 17. Fig. 1.

*Stegostoma fasciatum*, Müller und Henle, 24, Taf. (*Young.*)

*Stegostoma fasciatum*, Var. 1, Müller und Henle, 25. (*Young.*)

*Stegostoma fasciatum*, Var. 2, Müller und Henle, 25. (*Young.*)

*Stegostoma fasciatum*, Var. 3, Müller und Henle, 25. (*Mature?*)

*Stegostoma carinatum*, Blyth : Journ. As. Soc. XVI. 725, Pl. XXV.  
*bis*, Fig. 1. (*Young.*)

Yu tókay of the Malays.

(*Newborn and very young.*) Ground-colour above yellowish white with numerous broad black transverse bands, preponderating over the ground-colour, which on the head and fins is reduced to single rounded or oval spots; lower surface of the body and horizontal fins yellowish white. Iris black with a silvery line bordering the black linear pupil, which ascends obliquely backwards. (Russell, XVIII. *Poollee Makum.*—*Var.* 1, Müller und Henle).—TOTAL LENGTH: 12 to 13 inch.

(*Older.*) Ground-colour reddish- or brownish yellow, more conspicuous than in the newborn, particularly on the fins, where the brown colour is broken up into numerous rounded spots, (on the pectoral fins one or two large rings, with a central spot;) transversal bands reddish brown, with broad snuff-coloured or black margins; in some the bands of the head and body with numerous dark brown rounded spots. Iris like the ground-colour, but silvery. (*Var.* 2, Müller und Henle.—) TOTAL LENGTH: 1 ft. 10 to 3 ft.

(*Mature? Adult?*) Ground-colour whitish brown; head from behind the eyes, body and fins with numerous snuff-coloured rounded spots, which are somewhat indistinct on the fins. (*Scyllium heptagonum*, Rüppell.—*Var.* 3, Müller und Henle.—*Stegostoma carinatum*, Blyth.—) TOTAL LENGTH: 3 ft. to 5 ft. 7 inch.

HABIT.—*Sea of Pinang.*

Indian Ocean, Bay of Bengal, Jeddah, (Red Sea.)

All the descriptions of this species have been taken from young individuals. According to Gmelin it attains a length of about 15 ft. The largest specimen quoted above is a female, collected at Madras by W. Elliot, Esq. The length of the body is 2 ft., of the tail 3 ft. 7 inch. the proportion of the latter is therefore less than in younger individuals, where the tail forms  $\frac{2}{3}$  of the total length. The scales are rhombic, with a strong central keel and with 2 to 6 denticulations on each of the two anterior margins. In smaller individuals the scales are broad lanceolate, the central keel terminating in a sharp point, but the posterior margins are either not at all, or indistinctly denticulated. With age the seven raised keels become more distinct. Mr. Elliot has observed this species frequenting the shoals off the coast of Madras feeding on Molluscs. The stomach of several, dissected by him, contained large quantities of molluscous bodies, many of which with the opercula of different species of *Turbinidæ* attached. In a single young female, taken at Pinang in August 1845, the stomach contained remains of small *Crustacea*. Gmelin describes this species as feeding on *Crustacea* and *Testacea*. In a young individual 3 ft. in length, the male appendages did not exceed one half of the internal margins of the ventral fins. The Varieties, described by M. M. Müller and Henle, are but individual variations of the infantile livery.

## FAM. NYCTITANTIDÆ.

*A. without spiracles.*GEN. CARCHARIAS, (*Rafinesque*, 1810,) *Müller und Henle*, 1841.

Snout flattened, more or less rounded, moderately long. Nostrils in the centre between the mouth and the point of the snout, or nearer the mouth, at the lateral margin of the snout. Labial cartilage very minute or absent. Ovary of the embryo communicating with a kind of uterine placenta by means of plaited folds. Oviduct either smooth or flocculent.

SUB GEN. SCOLIODON, *Müller und Henle*, 1837.

Teeth of upper and lower jaw similar, but in the upper jaw appears an odd central tooth, trenchant, with the point directed outwards, but

not denticulated. The external part of the base forms a blunt protuberance, without or with a slight notch. Posterior dorsal fin placed either immediately opposite the anal, or above the posterior extremity of the latter. A distinct caudal groove above and beneath. Scales minute, tricarinate. Oviduct of the embryo flocculent.

**CARCHARIAS (SCOLIODON) ACUTUS, Rüppell.**

*Carcharias acutus*, Rüppell : Chondropt. 5, Tab. 18, Fig. 4.

*Carcharias (Scoliodon) acutus*, M. u. H. 29.

*Carcharias (Scoliodon) acutus*, Richardson : Rep. 1845, 194.

Yu of the Malays.

Head above, back, sides and fins lead-grey, or light bluish grey; beneath white. Iris light blue silvery, with a narrow silvery line bordering the black linear pupil.

**HABIT**:—*Sea of Pinang, Singapore, Malayan Peninsula.*

Indian Ocean, Red Sea, Java, China Seas.

**TOTAL LENGTH**: 3 ft.

The anterior dorsal fin is situated a little nearer the pectorals than the ventrals; the upper and posterior margin join in a narrow elongated point. The posterior dorsal commences opposite the posterior half of the base of the anal; both terminate in elongated points. The distance between the commencement of the ventrals and that of the anterior dorsal equals the distance from the commencement of the ventrals to that of the posterior dorsal fin. The fifth gill-opening is situated above the commencement of the pectorals. The scales are minute rounded, and with five, four or three keels. In young individuals the odd central tooth is considerably smaller than the rest. Single individuals occur during all seasons in the Straits of Malacca.

**SUB GEN. PRIONACE,\* Cantor.**

(*Equivalent to PRIONODON, Müller und Henle, 1841.*)

Teeth of either upper jaw, or of both jaws, finely denticulated on both sides, oblique or straight, trigonal, or with a small apex on a broad base. In the upper jaw almost invariably an odd central tooth. Oviduct of the embryo smooth, not flocculent.

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\* *Πρωγ, saw, ἀκη, edge.*—Substituted for *Prionodon*, pre-occupied by *Prionodon*, Horsfield, 1823, (*Mam.*) The characters given are those of M. M. Müller and Henle.

**CARCHARIAS (PRIONACE) MELANOPTERUS, Quoy et Gaimard.**

*Squalus carcharias minor*, Forskål : Descr. 20.

*Squale requin*, Lacép. V. 169, Tab. 8, Fig. 1.

*Carcharias melanopterus*, Quoy et Gaim. Freycin. Voy. Pl. 43,  
Fig. 1, 2.

*Squalus ustus*, Cuv. R. A. II. 388 (\*).

*Squalus spallanzanii*, Lesueur : Journ. Acad. Philad. II. P. 2, 351.

*Carcharias melanopterus*, Bennett : Life of Raffles, 693.

*Carcharias melanopterus*, Rüppell : Chondropt. 3.

*Carcharias (Prionodon) melanopterus*, M. u. H. 43, Taf. (Teeth.)

*Carcharias melanopterus*, Temm. et Schl. Faun. Japon.

*Carcharias (Prionodon) melanopterus*, Richardson : Rep. 1845,  
194, 317.

*Carcharias (Prionodon) melanopterus*, Bleeker : Verh. Batav. Gen. 6.

Head above, back, sides and fins lead-grey, or light bluish grey; anterior margins of the fins, (all the margins of the caudal,) and point of the pectorals bluish black; beneath white. Iris silvery grey with a blackish line bordering the vertically oval pupil.

**HABIT:**—*Straits of Malacca.*

Red Sea, Waigiou, New Holland, Timor, Java, Sumatra,  
Madura, China Sea, Japan.

**TOTAL LENGTH :** 3 ft.

In young individuals the teeth of the upper jaws have denticulated margins, but in the adult they are denticulated in both jaws. The teeth of the lower jaw are smaller and narrower than those of the upper. The anterior dorsal fin commences a little behind the termination of the pectorals; the posterior commences a little in front of the anal and extends to the posterior third of the latter fin. The points of all three are but moderately elongated. The ventrals commence at the posterior third of the distance between the commencement of the pectorals and the anal. The male appendages are shorter than the internal margin of the ventrals. The fourth and fifth branchial openings are situated above the pectorals. The snout is short and rounded in some, moderately elongated and pointed in others. The scales are minute, with from three to five keels. Single individuals occur at all seasons in the Straits of Malacca.

GEN. SPHYRNA, (*Rafinesque*, 1810), *Müller und Henle*, 1841.

(*ZYGAENA*, *Cuvier*, 1817.)

The anterior part of the head broad, flattened and laterally elongated; nostrils situated at the anterior margin; eyes at the lateral margins. Nasal valve a small triangular lobe at the internal margin of the nostril. No labial cartilage. Teeth of both jaws similar, resembling outwards pointing flattened pyramids, either trenchant or denticulated, with a section at the external margin of the base; central teeth in both jaws. Anterior dorsal nearer the pectorals than the ventrals; posterior dorsal smaller than the anterior, opposite the anal; incision of the caudal fin distinct. Oviduct of the embryos flocculent; ovary not attached to the walls of the uterus.

SPHYRNA ZYGAENA, (Linné.)

Libella, Belon, 61.

Zygaena, Rondelet, 389.

Gesner, Fol. LXXXII.

Libella, Salviani, 121, Tab. 40.

Aldrov. 408.

Jonston, Tab. VII. Fig. 8.

Willoughby: B. 1.

Ruysch: Theatr. Tab. VII. Fig. 8.

Zygène, Dutertre: Hist. Nat. II. 207.

Zygaena seu Libella, Jacob: Mus. 16, Taf. VII. Fig. 5.

Jochfisch, Valentini: Mus. Taf. XXXII. Fig. 5.

Zygaena, Ray, 20, 7.

Zygaena: Mus. Besler, Tab. XV. Fig. 1.

Klein: Miss. III. 13, No. 1.

Zygaena, Linné: Mus. Ad. Fr. 52.

Stampella, Scilla: Tab. 28, Fig. 2.

Squalus zygaena, Brünnich: Ichthyol. Massil. 4, No. 8.

Piscis libella, Bonnan: Mus. Kirch. Tab. XXXVII. Fig. 20.

Squalus zygaena, Forskål: Descr. XVIII.

Zygène: Duhamel: Sect. IX. Pl. XXI. F. 3-8.

Gronov. Mus. I. 63, 139.—Zoophyl. 146.

Le Marteau, Brousson. No. 11.

- Squalus zygaena*. Bloch. 117.  
 Martillo de Mar, Bru de Ramon. I. 51.  
 Cornudo, Parra, Lam. 32.  
*Squalus zygaena*, Linné : Syst. 1494.  
*Squalus*, No. 4, Browne : Jam. 558.  
 Artedi : Gen. Pisc. 44, 7. Synon. 96, 7.  
 Le Squalo marteau, Lacép. I. 257.  
 Le Squalo pantouffier, Ibid. 260, Pl. VII. Fig. 3.  
*Squalus zygaena*, Bl. Schn. 131.  
 Russell, XII. Koma Sorra. (*Young*.)  
*Squalus zygaena*, Shaw, V. 354, Pl. 154.  
*Zygaena malleus*, Risso : Ichth. 34, Hist. Nat. III. 125.  
*Sphyrna zygaena*, Rafin : Ind. 46.  
*Squalus zygaena*, Mitchill : Tr. Lit. and Phil. Soc. New York, I. 284.  
*Zygène marteau* : Dict. des Sc. Nat. T. 32.  
*Zygaena malleus* : Valenciennes : Mém. du Mus. IX. 223. Pl. II. Fig. 1. a. b.  
*Zygaena tudes*, Val. Ibid. Pl. XI. Fig. 3. (*Very young*.)  
*Zygaena malleus*, Cuv. R. A. II. 393.  
*Zygaena tudes*, Ibid. 394.  
*Zygaena lewisii*, Griffith : Anim. Kingd. Tab. 50.  
*Zygaena malleus*, Yarrell : II. 406.  
*Zygaena malleus*, Cantor : Quarterly Med. Journ. No. III. Calcutta, 1837, Fig. 1.  
*Zygaena tudes*, Cantor, Ibid. Fig. II. and : Transact. Med. and Phys. Soc. Calcutta : VIII. Pt. 2, Appendix, ccxj. Fig. I-II.  
*Zygaena malleus*, Swainson : I. 134.  
*Zygaena malleus*, Yarrell : Supplem. 61.  
*Sphyrna zygaena*, Bonaparte : Faun. Ital. Fasc. 27.  
*Zygaena tudes*, Agassiz : Recherches : III. Tab. E. Fig. 8, (Teeth.)  
*Sphyrna zygaena*, Müller und Henle, 51.  
*Sphyrna tudes*, Ibid. 53.  
*Zygaena malleus*, De Kay : Zoology of New York, IV. 362. Pl. LXII. Fig. 204. (*Young*.)  
*Sphyrna zygaena*, Richardson : Rep. 1845, 194.  
*Sphyrna tudes*, Bleeker : Verhandl. Batav. Gen. XXII. 6.



**Foetus.** Head above, back sides and fins rosy white, with a greyish tinge along the back; beneath white. Iris silvery light blue; pupil circular black. Total length: 1 ft. 0 $\frac{1}{4}$  inch.

**Young and Adult.** Body and fins slate grey; beneath white. Iris golden.

**HABIT.**—*Sea of Pinang, Singapore, Malayan Peninsula.*

Coasts of France, English Channel, Mediterranean, Atlantic, Indian Ocean, Bay of Bengal, Java, Madura, China Seas, Japan, Brazilian Coast, Nantucket, Cayenne, South Coast of Australia.

**TOTAL LENGTH:** 10 ft. 9 inch.

The anterior dorsal commences immediately behind the termination of the pectorals; the extent of the base is considerably less than  $\frac{2}{3}$  of the length of the anterior margin; the upper and the posterior margins join in a narrow, not much elongated point. The posterior, much smaller dorsal commences opposite the root of the anal, but terminates a little before the latter; both fins terminate in an elongated narrow point. The distance from the commencement of the ventrals to that of the pectorals is a little less than the distance between the commencement of the ventrals and that of the caudal. The fourth and fifth branchial openings are placed above the commencement of the pectorals. All the teeth are trenchant, not denticulated; those of the upper jaw appear somewhat broader than those of the lower. The scales are very minute with five or six keels. In the adult the anterior margin of the head forms a nearly uninterrupted or slightly festooned arch till it reaches the nostrils, where there is a more or less deep notch. The posterior margin is nearly parallel to the anterior. The nostrils open near the external part of the anterior margin of the head. From the nostrils proceeds a fissure along the external third of the anterior margin of the head. The length of the head, from the angle of the mouth, is about  $\frac{1}{3}$  of the breadth, or a straight line drawn between the eyes. The posterior margin of the head forms with the body an acute angle. Single individuals occur at all seasons in the Straits of Malacca. The largest examined was a female taken at Pinang in January 1845. In her were observed thirty-seven living young, of which twenty were males, seventeen females.

All were of the following dimensions :

|                                                           |                       |
|-----------------------------------------------------------|-----------------------|
| Length of the head from the angle of the mouth, . . . . . | 1 $\frac{1}{4}$ inch. |
| „ „ lateral margin of the head, . . . . .                 | 1                     |
| Distance between the eyes, . . . . .                      | 3 $\frac{1}{2}$       |
| „ from the angle of the mouth to anus, . . . . .          | 4 $\frac{1}{2}$       |
| „ „ anus to anal fin, . . . . .                           | 0 $\frac{7}{8}$       |
| Base of the anal, . . . . .                               | 0 $\frac{1}{2}$       |
| Height of do, . . . . .                                   | 0 $\frac{1}{2}$       |
| Distance from anal to caudal fin, . . . . .               | 0 $\frac{1}{2}$       |
| Length of caudal, . . . . .                               | 4                     |
| Base of anterior dorsal, . . . . .                        | 1 $\frac{2}{3}$       |
| Height of do., . . . . .                                  | 2                     |
| Base of posterior dorsal, . . . . .                       | 0 $\frac{1}{2}$       |
| Height of do., . . . . .                                  | 0 $\frac{7}{8}$       |
| Length of pectorals, . . . . .                            | 1 $\frac{2}{3}$       |
| Breadth of do., . . . . .                                 | 0 $\frac{2}{3}$       |
| Distance between the nostrils, . . . . .                  | 2 $\frac{1}{2}$       |
| Distance between the angles of the mouth, . . . . .       | 0 $\frac{1}{2}$       |

The foetus or very young differs from the adult in its more arched anterior margin of the head, and in the margin itself being more festooned. The length of the head is but little less than one-half of the breadth. From the nostrils proceeds an almost imperceptible fissure, and there is no notch in the anterior margin above them. The posterior margin of the head joins the body at a nearly right angle. (These are the distinguishing characters of *tudes*, Val.) The teeth of the foetus are barely perceptible to the touch. The lateral processes of the head are membranous ; but in each appear two narrow cartilaginous tubes, one containing the optic, the other the olfactorian nerve.

#### SPHYRNA BLOCHII, (Valenciennes.)

Bloch : 117.

Zygaena blochii, Valenciennes : Mém. du Mus. IX. Pl. XI. Fig. 2.  
(Foetus.)

Zygaena blochii, Cuv. R. A. II. 393<sup>(3)</sup>.

Zygaena blochii, Bennet : Life of Raffles, 694.

*Zygaena laticeps*, Cantor : Quarterly Med. Journ. Calcutta, 1837, Pl.  
1, 2, 3, (*Young*.)

*Zygaena blochii*. Ibid. Fig. IV. (*Foetus*) and Transact. Med. and  
Phys. Soc. Calcutta, VIII. Pt. II. App. cxi.

*Zygaena laticeps*, Swainson : I. 134, Fig. 11, and II. 318.

*Zygaena blochii*, Yarrell : Supplem. 64, Fig. 3, (*Foetus*.)

*Zygaena laticeps*, Ibid. Fig. 4, (*Young*.)

*Sphyrna blochii*, Müller und Henle, 54, 199. (*Young*.)

*Zygaena blochii*, Cantor in Ann. and Mag. of Nat. Hist. 1845.  
(*Adult and Foetus*.)

*Sphyrna blochii*, Bleeker : Verhand. Batav. Gen. XXII. 6.

Head, body and fins above bluish- or slate grey ; beneath white or  
pale yellowish. Iris golden ; pupil circular, black.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Bay of Bengal, Sumatra, Java, Borneo, Celebes, Madura.

TOTAL LENGTH : 4 ft. 4 inch.

In all ages the head is remarkably broad. The breadth of the head  
is not only liable to slight individual variations, but also to more consi-  
derable variations according to age. In the foetus the length of the  
head, the distance from the angle of the mouth to the anterior margin  
of the head is about  $\frac{1}{4}$  of the breadth, or the distance between the  
lateral margins of the head. With age the length diminishes to about  
 $\frac{1}{3}$ , which it has been found to be in the largest (adult ?) fish yet exa-  
mined, a female 4 feet 4 inch in length. The variations will be per-  
ceived by the following admeasurements.

| Total length.    | 4 ft. 4 in                | 3 ft. 8 in.               | 2 ft. 2 in.                | 1 ft. 11 in.              | 1 ft. 1 $\frac{1}{2}$ in. | 1 ft. 1 $\frac{1}{2}$ in. |
|------------------|---------------------------|---------------------------|----------------------------|---------------------------|---------------------------|---------------------------|
| Breadth of head. | 2 ft. 1 $\frac{1}{2}$ in. | 1 ft. 9 $\frac{1}{2}$ in. | 0 ft. 10 $\frac{1}{2}$ in. | 0 ft. 8 $\frac{1}{2}$ in. | 0 ft. 6 in.               | 0 ft. 4 $\frac{1}{2}$ in. |
| Length of do.    | ... 3 $\frac{1}{2}$ in.   | .... 3 $\frac{1}{2}$ in.  | ..... 1 $\frac{1}{2}$ in.  | .... 1 $\frac{1}{2}$ in.  | .... 1 $\frac{1}{2}$ in.  | .... 1 $\frac{1}{2}$ in.  |

A little more than the central third of the anterior margin of the  
head forms a large slightly undulating arch. At the termination  
of this arch appear the nostrils. In the foetus and the young the  
rest of the anterior margin is directed backwards, and the posterior  
margin joins the body at an acute angle. But in older individuals the  
anterior margin of the head, from the nostrils, is not directed back-  
wards, and the posterior margin joins the body at a right angle.

The fins are placed as they are in *S. sygaena*, except the posterior dorsal which commences but little in front of the termination of the anal. The following admeasurements were taken from the largest individual, 4 ft. 4 inch in length. She was a female captured at Pinang in September 1844.

|                                         |                       |
|-----------------------------------------|-----------------------|
| Distance between the nostrils, .....    | 9 $\frac{1}{4}$ inch. |
| „ between the angles of the mouth,..... | 5 $\frac{1}{2}$       |

She had eighteen living foetus, of which seven were males, eleven females. The lateral processes of the head were in all bent backwards and towards the sides of the body, so as to make the head resemble a broad arrow, as represented by M. Valenciennes. All the foetus were of the following dimensions:

|                                             |                        |
|---------------------------------------------|------------------------|
| Total length, .....                         | 13 $\frac{1}{4}$ inch. |
| Length of the head, .....                   | 1 $\frac{1}{2}$        |
| „ lateral margin of the head, .....         | 0 $\frac{1}{2}$        |
| Distance between the eyes,.....             | 6                      |
| „ from the angle of the mouth to anus,..... | 5                      |
| „ anus to anal fin, .....                   | 1 $\frac{1}{2}$        |
| Base of anal, .....                         | 0 $\frac{1}{2}$        |
| Height of ditto, .....                      | 0 $\frac{1}{2}$        |
| Distance from anal to caudal fin, .....     | 0 $\frac{1}{2}$        |
| Length of caudal, .....                     | 4 $\frac{1}{2}$        |
| Base of anterior dorsal, .....              | 1 $\frac{1}{4}$        |
| Height of ditto, .....                      | 2 $\frac{1}{4}$        |
| Base of posterior dorsal, .....             | 0 $\frac{1}{2}$        |
| Height of ditto, .....                      | 0 $\frac{1}{4}$        |
| Length of pectorals, .....                  | 1 $\frac{1}{2}$        |
| Breadth of ditto, .....                     | 1 $\frac{1}{2}$        |
| Distance between nostrils, .....            | 2                      |
| „ angles of the mouth, .....                | 0 $\frac{1}{2}$        |

In January 1845 another female occurred, 3 ft. 8 inch. in length, with fifteen living foetus. Of these ten were males, five females, all of which measured one foot in length. Young individuals, upwards of 3 ft. in length, are very numerous at all seasons in the Straits of Malacca. In the Bay of Bengal, in 21° N., the species is of rarer occurrence. The young feed on crustacea, the older on fishes.

## SUB-ORDO : RAJAE.

## FAM. SQUATINORAJOIDÆ.

GEN. PRISTIS, (*Latham*, 1794,) *Müller und Henle*, 1841.

(*PRISTIBATIS*, *Blainville*, 1828.)

Teeth of the saw generally uniform, flattened and trenchant, directed tolerably straight outwards, and commencing in front of the nostrils. Nostrils far removed from the mouth, with a long, narrow triangular valve at the upper margin; at the lower margin a hemlike valve. No cartilages at the angle of the mouth. Mouth transversal, straight. In the upper jaw a membranous transverse valve behind the teeth, with a straight margin. Teeth flattened, like paving stones. Upper eyelid without projection. Spiracles large, separated by a broad bridge from the eyes. Anterior dorsal partly opposite the ventrals. Both dorsals equal. Caudal short, with or without a lower lobe.

PRISTIS SEMISAGITTATUS, (*Shaw*.)

*Russell*, XIII. *Yahla* (*Very young*.)

*Squalus semisagittatus*, *Shaw*, V. 361.

*Pristis semisagittatus*, *Cuv. R. A. II.* 394 (?).

*Pristis semisagittatus*, *Swainson*, II. 319.

*Pristis semisagittatus*, *Müller und Henle*, (*Young*), 108, Taf. (Mouth and nostrils).

*Ikan garagáji* of the Malays.

Diluted yellow ochre; beneath whitish. Iris pale golden; pupil black, transversely oval.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Coromandel, Bay of Bengal, Mouths of the Ganges.

TOTAL LENGTH: 6 ft. 4 inch.

The nostrils are situated very near the mouth and extend close to the margin of the snout; from their external angle proceeds a short fissure towards the margin of the snout. The transversal duplicature or valve behind the teeth of the upper jaw has a deep notch at the symphysis of the jaw, and the margin is fringed in young individuals, as described by M. M. Müller and Henle. But in older ones (3 ft.

6 inch. in length,) the margin is smooth. The two dorsal fins are of equal size and form, the superior margin is very concave, and terminates in a narrow elongated point. In young individuals they join at an acute angle. The anterior dorsal commences opposite the termination of the ventrals; the distance from the termination of the posterior dorsal to the commencement of the caudal exceeds by one-half the base of the dorsal. The posterior margin of the caudal is deeply excavated so as to form a lower lobe, but little smaller than the upper. On the tail there is a sharp keel where the abdomen joins the sides; the keel is particularly raised between the posterior dorsal and caudal. The male appendages are styliform and project slightly beyond the inner margins of the ventrals, to which the anterior two-thirds are joined. The ventrals terminate in an elongated point. The external margin of the pectorals is concave. The anterior branchial opening is situated immediately beneath the commencement of the pectorals, the rest follow an oblique backwards and inwards direction. With the exception of the apex of the male appendages and the teeth of the saw, every other part of the body is covered with minute rounded or irregular scales, of unequal size. The back is rough to the touch in consequence of numerous tubercular scales, a little larger than the rest. All the scales have originally a minute central tubercle which, however, soon becomes worn. In the foetus the lateral margins of the saw are smooth and not yet pierced by the teeth. At the base the saw is naked to within a considerable distance (from 3 to 5 longitudinal diameters) of the eye. The first two or three teeth on each side of the apex of the saw are placed regularly opposite each other, the succeeding ones are not so. One of the margins carries from 4 to 7 more teeth than the other. The greater number present on one side varies from 25 to 34. In very young individuals, such as have been described by Russell and M. M. Müller and Henle, upwards of 3 ft. in length, each tooth has at the posterior margin a notch which forms a small barb, behind which the base of the tooth becomes narrower. But in individuals of about 4 ft. in length the notch is nearly effaced, and the basal half of the tooth is much broader than the other tapering half, which appears, as if it had been filed. With age the teeth become broad at the base, with trenchant margins tapering to a rounded trenchant point. The anterior margin is arched and

slightly directed backwards. The apical half of the teeth is slightly depressed. *Crustacea* form the food of the young, of which single occur in the Straits of Malacca at all seasons. Large individuals are seldom seen.

GEN. RHINA, (*Klein*, 1745,) *Müller und Henle*, 1841.

Snout rounded; spiracles immediately behind the eyes. Both the superior and inferior nasal valve extend to the inner angle of the nostril. Mouth deeply undulating. Teeth almost globular, not broader than long.

RHINA ANCYLOSTOMUS, Bloch-Schneider.

*Rhina ancylostomus*, Bloch-Schneider, 352, Tab. 72.

*Rhina ancylostomus*, Cuvier, R. A. II. 396 (\*).

(*Icon.*) *Rhina ancylostomus*, Gray: Ill. Ind. Zool. II. Pl. 102, Fig. 2. (Teeth.)

*Rhina ancylostomus*, Swainson, II. 322.

*Rhina ancylostomus*, Agassiz: Tab. H. Fig. 3, 4. (Teeth.)

*Rhina ancylostomus*, Owen: Odontogr. Pl. 23. (Teeth.)

*Rhina ancylostomus*, Müller und Henle, 110. (Very young.)

*Rhina ancylostomus*, Richardson: Report, 1845, 195.

Above earth-brown or deep skyblue; on the back, pectorals and caudal numerous distant whitish spots; beneath white. Iris pale golden; pupil black, transversely oval.

HABIT.—*Sea of Pinang.*

Indian Ocean, Madras, China Sea.

TOTAL LENGTH: 7 ft.

The distance between the nostrils exceeds the length of each nostril by about  $\frac{1}{4}$ . The distance of the nostrils from the margin of the head is  $\frac{1}{3}$  of their length. The horizontal diameter of the eye, which slightly exceeds the vertical, is a little more than  $\frac{1}{4}$  of the length of the nostril. The spiracles are nearly ovoid, their longest diameter  $\frac{1}{4}$  of the length of the nostrils; their distance from the eye is about  $\frac{1}{4}$  of its horizontal diameter. The pectorals, by far the largest of the fins, appear triangular and are nearly equilateral; the anterior convex margin is thickened, rounded and smooth; the posterior is straight and coarsely serrated. The branchial openings in position and form resemble those of *Pristis semisagittatus*. The anterior dorsal commences a little in front of the

ventrals and terminates a little before the termination of the latter fins. The base scarcely exceeds one-half of the height of the fin; the anterior margin is convex, the two others nearly straight; the angles are acute. The posterior dorsal is scarcely smaller than the anterior, which it resembles in form; it occupies the centre of the distance between the termination of the anterior dorsal and the commencement of the caudal. The posterior margin of the caudal is deeply excavated, and there is a lower lobe but little smaller than the upper. The caudal keel commences beneath the posterior dorsal fin. The ventrals resemble the anterior dorsal in form and size, but the posterior margin is excavated. The male appendages extend as far as the termination of the base of the posterior dorsal. The outline of the base of each tooth is rhomboidal, with the horizontal diameter slightly exceeding the vertical. The external surface is globular, covered with minute transverse undulating furrows. The largest teeth are situated on the two protuberances of the upper- and the three of the lower jaw. Immediately behind the teeth of the upper jaw, appears a transversal duplication or valve, with a smooth margin, but with a notch under the symphysis of the jaw. The valve, the palate and the flattened rounded tongue are all covered with scales like those of the rest of the body. They are very minute and consist of a triangular keel, rooted in the integuments, but projecting beyond them in an oblique backwards direction. Near the point the keel expands and presents a minute rhomboidal surface, so that the entire scale resembles the arm of an anchor with its fluke and peak. In many places the scales are worn down, become smooth and granular, and lose their original form. Larger and different scales are distributed in regular conspicuous crests. Of the latter there are two of an oval shape, placed obliquely, a little in front of and higher up than the eyes. Immediately behind this pair commences a second, each of which borders the supraciliar margin, and extends a little behind the upper margin of the spiracle. From each of the supraciliar crests proceeds a smaller narrower one downwards, bordering the anterior part of the orbit. From the centre between the supraorbital crests commences the dorsal, the longest of all, which extends to opposite the termination of the pectorals. Each scapular region carries a superior and an inferior crest, both of which are narrow and placed parallel to the dorsal crest. The superior is  $\frac{1}{2}$ , the inferior



$\frac{1}{2}$  of the length of the dorsal crest. A very short crest appears at the lower circumference of each spiracle. The crests are composed of single scales larger than the rest. All have a polygonal base from which rises a compressed thorn, from the apex of which numerous furrows radiate towards the base of the sides. On the snout, above and beneath, appear a number of pores. Opposite the spiracles, a little in front of the dorsal crest, the integuments are pierced by two large pores, placed side by side. The distance between these two is about one half of the distance from each to the nearest supraorbital crest.

The following dimensions were taken from a male, measuring 7 ft. in length.

|                                                                                     |                             |
|-------------------------------------------------------------------------------------|-----------------------------|
| Distance from the apex of the snout to the mouth, ..                                | 0 ft. 6 $\frac{1}{2}$ inch. |
| „ from the mouth to the middle between the terminations of the pectoral fins, ..... | 1 6                         |
| „ from thence to the anus, .....                                                    | 1 0                         |
| „ from the anus to the caudal. ....                                                 | 2 3 $\frac{1}{2}$           |
| Length of the upper lobe of the caudal, .....                                       | 1 6                         |
| „ of the lower lobe of ditto, .....                                                 | 1 1 $\frac{1}{2}$           |
| „ of the base of the anterior dorsal, .....                                         | 0 5 $\frac{1}{2}$           |
| Height of the fin, .....                                                            | 0 10 $\frac{1}{4}$          |
| Length of the base of the posterior do. ....                                        | 0 4 $\frac{1}{2}$           |
| Height of the fin, .....                                                            | 0 10                        |
| Distance between the anterior angles of the pectorals, ..                           | 3 8 $\frac{1}{4}$           |
| Length of the base of the pectorals, .....                                          | 1 2 $\frac{1}{4}$           |
| „ of the base of the ventrals, .....                                                | 0 4 $\frac{1}{4}$           |
| „ of the male appendages, .....                                                     | 1 2                         |
| Breadth of the mouth, .....                                                         | 0 7                         |
| Length of the supraorbital crests, .....                                            | 0 8 $\frac{1}{2}$           |
| „ of the dorsal crest, .....                                                        | 1 4                         |
| Greatest diameter of the nostril, .....                                             | 0 4 $\frac{1}{2}$           |
| „ of the eye, .....                                                                 | 0 1 $\frac{1}{2}$           |
| „ of the spiracle, .....                                                            | 0 2 $\frac{1}{2}$           |

The description of M. M. Müller and Henle is taken from a very young individual. During four years three solitary individuals occurred at Pinang. According to Lord Arthur Hay and Mr. Walter Elliot they are of more frequent occurrence at Madras. Mr. Elliot, who has observed the habits of the fish, describes it as hugging the shore,

moving slowly along the bottom. Hence the Tamil name: "*Masa Ulavi*," i. e. "Mud-skate." In some dissected, Mr. Elliot observed fragments of *Crustacea* in prodigious quantities.

GEN. *RYNCHOBATUS*, Müller und Henle, 1839.

Snout elongated, acute, with a tapering keel along the middle. The interval between the keel and the inner margin of the pectorals is membranous; spiracles immediately behind the eyes. Upper eyelid with a simple projection. Upper and lower nasal valve extend but halfway to the internal angle of the nostril; outside in front, at the upper margin of the nostril is a narrow hem. The undulations of the snout, particularly the lateral ones, are shallow. Teeth broader than long, with a transversal protuberance. A transversal arched row of pores on the abdominal surface of the scapular region.

*RYNCHOBATUS DJEDDENSIS*, (Forskål.)

Duham. Sect. IX. Pl. 15.

*Raja dsiddensis*, Forskål: Descr. 18.

*Raja dsiddensis*, Linné: Syst. 1511.

*Rhinobate rhinobate*, Lacépède, I. Pl. VI.

*Raie bohkat*, Lacép. I. 139.

*Rhinobatus laevis*, Bloch-Schneider, Tab. 71 (*Young*.)

Russell, X. Walawah Tenkee (*Young*.)

*Raja djiddensis*, Shaw, V. 319.

*Rhinobate lisse*: Dict. des Sc. Nat. 19.

*Rhinobatus laevis*, Cuvier, R. A. II. 396(').

*Rhinobatus djeddensis*, Rüppell: Atlas, 54, Taf. 14, Fig. 1.

*Rhinobatus djeddensis*, Bennett: Life of Raffles, 693.

*Rhinobatus djettensis*, Rüppell: Neue Wirbelth. Fische, 68.

*Rhinobatus duhamelii*, Blainville: Faune: Fr. 148.

*Rhinobatus laevis*, Swainson, II. 322.

*Rhynchobatus laevis*, Müller und Henle, 111.

(*Young*.) Above light greenish olive, pale yellowish- or reddish brown, with a downwards arched black band on the upper eyelid; a small black spot on each side of the point of the snout; a large oval black spot surrounded by several white (from 3 to 6) ones above the middle of the base of the pectorals, and with more or less numerous white spots on the pectorals and the sides, where in some they are dis-

posed in longitudinal lines ; sides of the snout, pectorals and ventrals in some tinged with carmine ; beneath whitish. Iris golden ; pupil transversely oval, black. (Bloch-Schneider.—Russell, X.—*Var.* 2, Müller und Henle.)

*Var.* 3. Müller und Henle.—With numerous round spots on the snout, head, back, tail and pectorals. (*Rhinobatus djeddensis*, Rüppell.)

(*Adult.*) Either uniformly coloured, or with indistinct spots ; but without spots at the point of the snout, and without bands on the upper eyelid.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Indian Ocean, Bay of Bengal, Red Sea.

TOTAL LENGTH: 5 feet.

Spiracles with two denticulations at the posterior margin. The length of the snout is a little less than  $\frac{1}{7}$  of the total. The distance of the nostril from the lateral margin is  $\frac{1}{4}$  of the length of the nostril. The distance between the anterior extremities of the nostrils is double the length of each nostril ; the distance between the posterior extremities is a little less than the length of each nostril. The anterior dorsal commences a little behind the commencement of the ventrals, and extends a little farther back than the latter. The extent of the base is less than one half of the anterior margin. The posterior dorsal is smaller ; its distance from the caudal is a little more than one half of the distance from the anterior dorsal. Both dorsals are similar, terminating in an attenuated point, but the posterior is much the smaller. The extent of their base is less than one half of their anterior margin. The pectorals appear triangular. The ventrals terminate in an attenuated point, which extends to the opposite point of the anterior dorsal. The posterior margin of the caudal is very concave ; the lower lobe but little smaller than the upper. The lateral keel commences a little above the termination of the ventrals. The scales are very minute subrhomboidal or orbicular and imbricated ; they carry from 3 to 6 keels. A number of small recurvous spines are at intervals distributed in lines. One such, the supraorbital, surrounds the anterior part of the orbit, and extends backwards to above the spiracle. Another, the dorsal, extends along the spine to the posterior dorsal. As in *Rhina ancylostomus*, there appear two conspicuous pores a little in front of the dorsal line. In young individuals these pores are less distinct. A

little behind the occiput, on each side, appears a short backwards diverging line of spines. Each shoulder carries a second, a little longer, also directed backwards. In large individuals there is another line beneath the scapular. It consists but of two or three spines.

The following dimensions were taken from a female 4 ft.  $1\frac{1}{2}$  inch in length.

|                                                                               |                            |
|-------------------------------------------------------------------------------|----------------------------|
| From the snout to the mouth, .....                                            | 0 ft. $8\frac{1}{2}$ inch. |
| From the mouth to the anus, .....                                             | 1     3                    |
| From the anus to the caudal, .....                                            | 1     6                    |
| Length of the caudal, .....                                                   | 0     8                    |
| Distance between the anterior angles of the pectorals, .....                  | 1 $3\frac{1}{2}$           |
| From the snout to the eyes, .....                                             | 0 $7\frac{1}{2}$           |
| Distance between the orbits, .....                                            | 0 $2\frac{1}{2}$           |
| „     between the internal angles of the nostrils, .....                      | 0 $1\frac{1}{2}$           |
| Breadth of the mouth, .....                                                   | 0     3                    |
| From the point of the snout to the end of the base<br>of the pectorals, ..... | 1 $6\frac{1}{2}$           |
| Greatest breadth of the keel of the snout .....                               | 0 $1\frac{1}{2}$           |
| Distance between the dorsals .....                                            | 0     9                    |
| „     between the posterior dorsal and caudal ..                              | 0 $5\frac{1}{2}$           |
| „     between the pectorals and ventrals, .....                               | 3                          |

Single individuals occur at all seasons in the Straits of Malacca.

GEN. RHINOBATUS, (*Bloch-Schn.* 1801) *Müller und Henle*, 1841.

Skull elongated in a keel, the interval between which and the internal margin of the pectorals is membranous; snout more or less pointed. The upper nasal valve consists, as in *Rhynchobatus*, of an external narrow elongated lobule, and an internal which is broader and shorter. The external lobule is narrow, but its rounded apex extends to the lower margin of the nostril, and does not project at an angle from the inner lobule. The external lobule is situated nearly in the middle of the upper margin of the nostril; the internal lobule extends more or less inwards. The lower nasal valve extends from the external angle more or less inwards. Spiracle and eye surrounded by a common fleshy wall. The upper eyelid carries in the centre a projection. The valve of the upper jaw has a fringed margin and is notched in the centre. The anterior part of the lateral margin of the disk has two slight undulations.

## SUB-GEN. RHINOBATUS, Müller und Henle, 1841.

The upper nasal valve does not extend to the inner angle of the nostril.

## RHINOBATUS (RHINOBATUS) LIGONIFER, Cantor.

## Plate XIV.

(Young ?) Keel of the snout, head, body and fins above greenish ash-grey; snout and abdominal surface white. Iris pale golden of the general colour; pupil broad cordate, black.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

TOTAL LENGTH: 1 foot  $4\frac{1}{2}$  inch.

This species greatly resembles *Rhinobatus thouini*,\* but differs from the latter as described by M. M. Müller and Henle, in the following characters. The lateral margins of the snout, a little from the apex are deeply bent inwards, and nearer the apex they are similarly, but less distinctly, bent a second time. The apex thus somewhat resembles the figure 8. The keel is not smooth, but covered to the very point with small distant recurvous thorns, like those of the rest of the upper part of the body. The shallow furrow of the keel extends considerably in front of the eyes. Each spiracle carries two distinct denticulations. The pectinations of the nostrils vary from 85 to 90, (in *R. thouini* about 60). The teeth vary from 75 to 80 in a series (in *R. thouini* about 60). The scapular region carries an outer-, and a larger inner thorn. In *R. thouini* the inner thorn is the smaller of the two.

The keel is most contracted a little in front of the eyes, the breadth being about  $\frac{1}{8}$  of the length. From thence it slowly widens towards the 8-shaped apex, which is about  $\frac{1}{2}$  of the length of the keel. The shallow lanceolate furrow commences between the eyes and extends as far beyond them as the basal sixth of the keel. The posterior margin of the spiracle carries a smaller internal, and a larger external denticulation. The distance between the nostrils is one half of the length of each nostril, and it slightly exceeds the distance between the lateral

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\* *Raja thouin*, Lacép. I. Pl. 1, Fig. 3-5.—*Raja thouiniana*, Shaw: V. 318. Pl. 147.—*Rhinobatus thouin*, Cav. R. A. II. 396. (2).—*Rhinobatus (Rhinobatus) thouini*, M. und H. 120.

margin of the head and the nostrils. The upper nasal valve extends as far as the inner third of the margin. The distance between the orbital thorns exceeds by  $\frac{1}{2}$  the length of the orbit and spiracle together. The pectoral fins are rounded. The ventrals are subrhomboidal, terminating in an acute point; the male appendages are somewhat shorter than the inner margins. The posterior dorsal is very little larger than the anterior. The lateral keel commences a little behind the ventrals. The upper surface of the snout, body and fins is covered with small distant scales. They are all directed backwards, and resemble those of *Rhina ancylostomus*. The keel of the snout and the upper surface of the head are covered with minute thorns. Three to five larger thorns border the anterior margin of the orbit; two the inner margin of the spiracle. The largest thorns are placed at intervals along the spine of the back, and the line extends as far as the posterior dorsal fin. In front of the dorsal series appear two pores, as in *Rhina ancylostomus*. In each scapular region appears an isolated thorn, and outside of that a second smaller one. The thorns are all compressed, with a broad oval base with radiating lines. The lower surface of the snout is covered with minute somewhat distant scales, which are triangular, with the apex directed backwards. Those of the rest of the lower surface are nearly round, with an indistinct central tubercle. The abdominal surface of the scapular region is on each side marked by an undulating linear furrow. The cavity of the mouth and the large flattened tongue are covered with minute triangular scales. The membranous valve behind the teeth of the upper jaw has a large notch in the centre and a smaller one at each angle of the mouth. The margins of the smaller notches are fringed.

The following dimensions were taken from a female 1 ft.  $4\frac{1}{2}$  inch in length.

|                                                           |                      |
|-----------------------------------------------------------|----------------------|
| From the snout to the internal angle of the nostril, .... | $3\frac{1}{2}$ inch. |
| From thence to the mouth, .....                           | $0\frac{1}{2}$       |
| From the mouth to the anus, .....                         | $3\frac{1}{2}$       |
| From the anus to the point of the caudal, .....           | 9                    |
| Distance between the nostrils, .....                      | $0\frac{1}{2}$       |
| Length of the nostrils, .....                             | 1                    |
| Breadth of the mouth. ....                                | $1\frac{1}{2}$       |
| Greatest breadth of the disk, .....                       | $5\frac{1}{2}$       |

|                                                              |                 |
|--------------------------------------------------------------|-----------------|
| Distance from the ventrals to the anterior dorsal, . . . . . | 1 $\frac{1}{2}$ |
| „ between the dorsals, . . . . .                             | 1 $\frac{1}{2}$ |
| „ between the posterior dorsal and the caudal, ..            | 0 $\frac{1}{2}$ |
| Length of the caudal, . . . . .                              | 2 $\frac{1}{2}$ |

Solitary individuals occur during all seasons in the Straits of Malacca.

*PLATYRHINA*\* *SINENSIS*, Müller und Henle, occurs, but rarely, at Singapore and Pinang.

### FAM. TORPEDINIDÆ.

#### A. With two dorsal fins.

#### GEN. NARCINE, Henle, 1834.

Disk orbicular, elliptical or angulated, rounded in front and provided with a broad keel. Mouth small, protractile, surrounded by a circular skinny fold, which terminates above in the frænulum† of the nasal valve. Nasal valve straight, with a central projection, and sometimes with the lateral projections slightly elongated, making the valve trifid. A labial cartilage above and beneath. Teeth in quincunx, with a point in the middle. They project beyond the margin of the jaw like an elliptical plate. The lips not fixed to the jaws, but moveable. A membranous valve behind the upper jaw. Tail longer than the disk. The anterior dorsal behind the ventrals, smaller than the posterior. Spiracles immediately behind the eyes. Margins of the spiracles smooth.

#### NARCINE INDICA, Henle.

*Narcine indica*, Henle: *Narcine*, 35, Taf. II. Fig. 2.

*Narcine indica*, Müller und Henle, 130.

*Pari kubbas* of the Malays.

Body and fins above light reddish brown or copper-coloured, with numerous larger and smaller chocolate-coloured spots, in young indivi-

\* Pre-occupied by *Platyrrhinus*, Clairville, 1798. (*Coleopt.*)

† "Bändchen."

duals broadly edged with silvery white. The spots generally circular, some oval, others confluent. Beneath whitish. Iris narrow golden; pupil triangular, with the apex downwards, black; margins of the spiracles flesh-coloured.

**HABIT.**—*Sea of Pinang.*

Tranquebar.

**TOTAL LENGTH:** 1 ft. 6 inch.

The disk has a pentagonal appearance and is but very little broader than long. The tail is slightly longer than the body. In very young individuals it is a little shorter than the body. The ventrals are not covered by the pectorals; their angles are acute, their anterior margin slightly concave. The male appendages project but slightly beyond the inner margin of the ventrals. The anterior dorsal commences opposite the termination of the ventrals. In the young the apex forms an acute angle, later it becomes rounded. The extent of the base is  $\frac{1}{4}$  of the length of the anterior margin. The distance between the two dorsals equals that between the posterior and the caudal. Both dorsals are of similar form and size. The posterior margin of the caudal is very convex. The following dimensions were taken from a female, measuring  $11\frac{1}{2}$  inches in length.

|                                                 |                       |
|-------------------------------------------------|-----------------------|
| From the snout to the mouth, .....              | 1 $\frac{1}{2}$ inch. |
| From the mouth to the anus, .....               | 3 $\frac{1}{4}$       |
| From the anus to the point of the caudal, ..... | 5 $\frac{1}{2}$       |
| Length of the disk, .....                       | 5 $\frac{1}{4}$       |
| Breadth of the disk, .....                      | 5 $\frac{1}{4}$       |

Large individuals are at Pinang of rare occurrence, but younger, from 3 to 6 inches in length, are taken at all seasons. In or out of water they may be handled with impunity. Several species of fishes introduced in a jar filled with sea-water and containing a large *Narcisæ* shewed no consequences from the contact, nor did they appear to avoid the Torpedo. The food of this and the other Malayan *Torpedinidæ* consists of *Crustacea* and *Testacea*.

*B. With one dorsal fin.*

**GEN. ASTRAPE,** *Müller und Henle*, 1837.

Snout short without keel, generally similar to that of *Narcisæ*. Frænulum of the nasal valve with a cylindrical cartilage. Teeth



pointed with a tetragonal base, but slightly projecting beyond the margin of the jaw. A membranous valve in both jaws. The solitary dorsal and the caudal rounded. Eyes close to the spiracles. The latter smooth.

# ASTRAPE DIPTERYGIA, (Bloch-Schneider.)

*Raja dipterygia*, Bloch-Schneider, 359.

*Torpedo dipterygia*, Var. *Olfers*. *Torp.* 25.

*Narcine dipterygia*, Henle : *Narcine* : *Taf.* III. *Fig.* 2.

*Astrape dipterygia*, Müller und Henle : 131. (*Young.*)

*Pari kubbas* of the Malays.

Above dark greenish olive, with a large round whitish spot on each side at the posterior margin of the disk ; anterior half of the ventrals whitish ; a large round whitish spot on each side above the termination of the ventrals, a similar one on each side of the root of the caudal ; dorsal and caudal blackish brown or black ; beneath whitish. Iris golden ; pupil circular black.

In the very young (upwards of  $4\frac{1}{2}$  inch in length) the ventrals are of a uniform colour like the ground-colour.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Lencay Islands, Singapore.*

Tranquebar.

**TOTAL LENGTH :** 8 inch.

The disk is rounded, and as broad as long. It covers the anterior margin of the ventrals. The latter are tetragonal, with acute angles in the young, but later they become obtuse. The male appendages are strong and extend to opposite the termination of the dorsal. The latter commences at the posterior third of the length of the fish. The eyes are much smaller than the spiracles. The following dimensions were taken from a male  $6\frac{1}{2}$  inch in length.

|                                                                    |                |
|--------------------------------------------------------------------|----------------|
| Length and breadth of the disk, . . . . .                          | 3 inch.        |
| From the snout to the mouth, . . . . .                             | $0\frac{1}{2}$ |
| From the mouth to the anus, . . . . .                              | $2\frac{1}{2}$ |
| From the anus to the apex of the caudal, . . . . .                 | $3\frac{1}{2}$ |
| Single individuals occur in the Straits of Malacca at all seasons. |                |

## C. Without dorsal fins.

## GEN. TEMERA,\* Gray, 1831.

Body orbicular; ventral fins large, produced, nearly square; tail very short, and compressed, finned; dorsal fin none; most nearly allied to *Torpedo*, but differs in having no dorsal fin, in which character it is most nearly allied to *Narke* of Cuvier, a genus not noticed by Cuvier, which has only one dorsal fin, while *Torpedo* has two.

## TEMERA HARDWICKII, Gray.

## Plate XII, Fig. 1-2.

*Temera hardwickii*, Gray: Zool. Misc. 7. (Young.)

(Icon.) *Temera hardwickii*, Gray: Ill. Ind. Zool. II. Pl. 102. (Young.)

*Temera hardwickii*, Müller und Henle, 131, Taf. Fig. 1,  
(Mouth and Teeth)

*Pari kubbas linchin* of the Malays.

Above light yellowish brown; margins of spiracles flesh-coloured; whitish beneath. Iris golden; pupil transversely oval, black.

In some the disk and tail above have large irregular white patches.  
(*Var. 2. M. und H.*)

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

TOTAL LENGTH: 1 ft. 6 inch.

The disk is nearly round, but the snout between the eyes appears truncated. The relative proportions of the length and breadth appears to be liable to slight individual variations. In some the disk is a little longer than it is broad, in others vice versâ. The eyes are as large as the spiracles. The ventrals are not covered by the pectorals. The following dimensions were taken from a female  $4\frac{1}{2}$  inch in length.

|                                                 |                      |
|-------------------------------------------------|----------------------|
| From the snout to the mouth, .....              | $0\frac{1}{2}$ inch. |
| From the mouth to the anus, .....               | $2\frac{1}{4}$       |
| From the anus to the point of the caudal, ..... | $1\frac{1}{2}$       |
| Length of the disk, .....                       | $2\frac{1}{4}$       |
| Breadth of the disk, .....                      | $2\frac{1}{4}$       |

\* "Snout, mouth and membranous valve of the jaws as in *Astrepe*. Tail without dorsal fin, short in proportion to the disk. Spiracles immediately behind the eyes, smooth. Teeth flattened." (Müller und Henle, page 131.)

She had four foetus, each  $1\frac{1}{2}$  inch in length, in colour and form resembling the mature fish. But the vertical diameter is in the foetus proportionally greater. In the Straits of Malacca this species is at all seasons very numerous.

The electric organs (Pl. XII. Fig. 1, *a. u.*) are of an elongated tetragonal arched form, and occupy the sides of the disk. They occupy the space between the snout and the abdominal cavity, their internal concave margin bordering the branchial apertures. The length of each is a little more than  $\frac{1}{3}$  of the length of the fish, and each occupies a space about double that of the abdominal cavity. Each organ is composed of a number of pentagonal or hexagonal cells, filled with a transparent colourless fluid. The anterior and external margins are surrounded by a bundle of cartilaginous fascicles (*b.*), outside of which appears a long cutaneous nerve (*c.*), from which proceed at right angles a number of small branches towards the external margin of the pectoral fins. The abdominal cavity (*d.*) is remarkably reduced. The intestinal canal, from the entrance of the Ductus coledochus, measures  $\frac{1}{4}$  of the total length of the fish. The liver consists of two large, elongated lobes. Beneath the anterior part of the right lobe appears the small oval gall-bladder. The small linear spleen is attached to the major arch of the stomach, close to the pylorus.

Plate XII. Fig. 2 represents the brains, viewed from above. Immediately behind the spiracles (*a.* the left,) appear two branches of *Trigeminus*. The anterior (*b.*) proceeds along the anterior margin of the electric organ, the posterior (*c.*) also supplies the anterior part of the organ. The posterior part of the organ is supplied by two very large branches of *Pneumogastricus* (*d. e.*).

Many of these fishes are infested by minute *Entosoa*. They occupy the cellular tissue immediately beneath the integuments of every part of the body, the electric organs not excepted. It is a *Cystocercus*, barely perceptible to the naked eye.

*CYSTOCERCUS TEMERÆ*, Cantor. (Pl. XII. Fig. 3.) Of a pyriform shape. From the oval bladder proceeds the conical, elongated neck, which terminates in a pore, surrounded by recurvous spines. The colour is hyaline with numerous brownish dots; the cavity of the bladder is pale greenish. The figure is magnified, as it appeared under  $\frac{1}{16}$  single lens.

## FAM. TRYGONISIDÆ.

*A. Tail without spine.*GEN. RHACHINOTUS,\* *Cantor.**(Equivalent to ANACANTHUS, Ehrenberg, 1837.)*

Teeth flattened. Tail without radiated fin, but with a skinny hem beneath, or naked.

## RHACHINOTUS AFRICANUS, (Bloch-Schneider.)

*Raja africana*, Bloch-Schneider, 367.

*Anacanthus africanus*, Müller und Henle, 157.

Above greenish white; beneath white. Iris golden greenish; pupil triangular, black.

HABIT.—*Sea of Pinang.*

Guinea, Red Sea.

The disk is rounded, a little narrower towards the tail than towards the slightly projecting pointed snout. A space about 4 inches in breadth, comprising the snout, forehead and the pectoral fins, is free from scales, but sparingly covered with distant thorns. The latter, of which none exceed  $\frac{1}{2}$  inch in height, stand erect on a rounded or oval radiated base. The head from between the eyes, the back and the anterior two-thirds of the tail, (the latter above and beneath,) are thickly covered with small heart-shaped scales. Their surface is smooth, obliquely raised towards the apex, which is generally directed inwards to the mesial line of the body. Their margin is abrupt, with three or four concentric lines or strata. Between the scales are scattered a number of single thorns, the longest of which are about  $\frac{1}{8}$  of an inch. Their base is stellate, with three to five roots fitting into the intervals between the nearest scales. The thorns are generally erect, but those of the posterior part of the back and of the tail are directed slightly backwards. On the upper part of the anterior fifth of the tail the thorns cease. The tail is compressed, gradually tapering to a narrow point, and densely covered with scales as far as the posterior third, where they become few and far between. The abdominal surface of the tail, as far as the thorns extend, is broad, convex; the rest is acute and

\* 'Páxos thornbush; vâros back. Substituted for *Anacanthus*, Ehrenberg, 1837, pre-occupied by *Anacanthus*, Gray, 1831, (*Pisc.*) and *Anacanthus*, Serville, 1832, (*Coleopt.*)

presents a naked, indistinct, skinny hem. The abdominal surface of the body is smooth, naked.

|                                                     |       |                       |
|-----------------------------------------------------|-------|-----------------------|
| Length from the point of the snout to the mouth, .. | 0 ft. | 2 $\frac{1}{2}$ inch. |
| From the mouth to the anus, .....                   | 1     | 0 $\frac{1}{2}$       |
| From the anus to the apex of the tail, .....        | 1     | 7 $\frac{1}{2}$       |
| Distance between the eyes, .....                    | 0     | 2 $\frac{1}{2}$       |
| Greatest breadth of the disk, .....                 | 1     | 4                     |

A single female occurred at Pinang in December 1843.

GEN. TRYGON, (*Adanson*,) *Müller und Henle* 1841.

Disk oval or rhombic; tail as long as the body or longer, without hem, or with hems not extending to the apex. Mouth a little arched. Teeth with a central point or transversal tubercle, which in some is rough, with a more or less distinct transversal furrow in front and behind; the furrow of the lateral teeth becomes more distinct. The whole surface is more or less wrinkled. Membranous valve of the upper jaw with a straight, deeply fringed margin; a second posterior valve deeply notched. In the lower jaw behind the teeth appear generally several papillæ.

*A. Tail without fin.*

TRYGON UARNAK, (*Forskål.*)

*Raja omnescherit*, *Forskål*, *Descr.* IX.

*Raja uarnak*, *ibid.* 18, No. 16, b.

*Raja uarnak*, *Linné*: *Syst.* 1509.

*Raja uarnak*, *Bloch-Schn.* 364.

*Pastinachus uarnak*, *Rüppell*: *Neue Wirbelth. Fische*, 69,  
Taf. 19, Fig. 2. a. b.

(*Icon*). *Trygon russelli*: *Gray*: *Ill. Ind. Zool.* II. Pl. 100.

*Trygon variegatus*, *McClelland*: *Calcutta Journal of Nat.*  
*Hist.* I. 60, Pl. II. Fig. 2.

*Trygon uarnak*, *Müller und Henle*, 158.\*

*Trygon uarnak*, Var. 1, *Müller und Henle*, 158 } (*Adult.*)

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\* M. M. Müller and Henle, quote as synonymes:

"*Trygon uarnak*, } *Rüppell*, *Atlas*, p. 51."  
"Trygon omescherit,"

The quotation, which has been repeated by Sir John Richardson, l. c., is a mistake. The two names occur neither in page 51, nor in the "Alphabetisches Verzeichniss" of Dr. Rüppell's *Atlas*.

*Trygon uarnak*, Var. 2, 3, 4, Müller und Henle, 158 (*Young*).

*Trygon uarnack*, Richardson : Report, 1845, 197.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Singapore.*

Indian Ocean, Red Sea, Bay of Bengal, Mouths of the Ganges, China Sea, Cape of Good Hope.

(*Young*.) Body above light reddish brown or greenish-olive, with numerous black spots, between which the ground-colour appears like a network; beneath whitish; tail brownish white with numerous black rings or transversal bands. (Disk 6 to 9 inch. broad.—*Var.* 2 and 4, M. u. H.)

(*Older*.) Brownish- or greyish- olive with numerous whitish spots; posterior part of tail in some with indistinct blackish or whitish rings. (Disk 3 ft. broad.—*Var.* 3, M. u. H.)

(*Adult*.) Uniformly brownish- or greenish- olive. Iris golden; pupil transversely oval.

In the very young individuals the eyes are very prominent and project above the level of the spiracles. The skin is naked, and in the centre of the back appears but a single heart-shaped white tubercle. In a spotted individual, 9 inches broad, there is a second smaller heart-shaped tubercle behind the former, and the head and the sides along the spine of the back are scantily covered with minute distant heart-shaped scales, which on the root of the tail are placed in a double longitudinal series. On the tail appear numerous very minute, distant thorns, which later disappear. In older individuals (upwards of 3 ft. broad,) the head, back and sides and the anterior half of the tail are covered with smooth orbicular scales, the intervals between which are filled with many smaller than the rest.

The disk is a little broader than long. The distance from the point of the snout to the centre between the nostrils exceeds by one third the distance between the nostrils. The snout is more prominent in the young than in the adult. The tail is compressed towards the spine, the rest cylindrical, tapering to a thin point. Its length is about four times that of the body. On the lower surface appears a very indistinct skinny hem. The spine is situated at the termination of the anterior seventh or ninth of the tail. Its length is liable to considerable individual variations. The following dimensions were taken from a young male, (*Var.* 3, M. u. H.)

|                                      |                             |
|--------------------------------------|-----------------------------|
| From the snout to the mouth, .....   | 0 ft. 3 $\frac{1}{4}$ inch. |
| „ mouth to the anus, .....           | 1 0 $\frac{1}{4}$           |
| Length of the tail, .....            | 5 3 $\frac{1}{2}$           |
| Greatest breadth of the disk, .....  | 1 10 $\frac{1}{4}$          |
| Distance between the nostrils, ..... | 0 1 $\frac{1}{4}$           |
| „ „ eyes, .....                      | 0 3                         |
| „ from the snout to the eyes, .....  | 0 3 $\frac{1}{4}$           |
| Breadth of the mouth, .....          | 0 1 $\frac{1}{2}$           |

Young individuals of this species are numerous at all seasons in the Straits of Malacca, but larger ones, with the body about 4 ft. in length, are uncommon.

#### TRYGON IMBRICATA, (Bloch-Schneider).

*Raja imbricata*, Bloch-Schn. 366.

Russell, IV. Isacurrah Tenkee. (*Very young*.)

Cuv. R. A. II. 399 (\*).

*Trygon imbricata*, Müller und Henle, 164.

*Trygon imbricata*, Bleeker: Verh. Batav. Genoots. XXII. 6.

Above lighter or darker brown; the tail in some lighter than the body; beneath white. Iris golden; pupil transversely oval.

**HABIT.**—*Sea of Pinang, Singapore, Malayan Peninsula.*

Bay of Bengal, Java, Madura.

The snout is acutely pointed; the disk is of equal length and breadth; the external and the posterior angle of the pectorals are rounded. The distance between the nostrils is less than one half of that from the snout to the centre between the nostrils. The tail is but little longer than the body. The head from between the eyes is covered with minute, somewhat distant scales. They are heart-shaped, of unequal size, with the apex directed towards the snout. On the back appears an irregularly oval patch of similar scales, with their points directed towards the tail. Between the occiput and the scapular region appear a series of single scales larger than the rest. The anterior fourth of the tail is compressed and above covered with scales like those of the back, with a mesial line of distant lanceolate scales, which gradually increase in length towards the two spines. The anterior of the two spines is situated at the termination of the anterior fourth of the tail. It is a little shorter than the posterior, which is situated a little more

backwards, and is about  $\frac{1}{2}$  of the length of the tail. Behind the two spines the tail is naked and becomes very slender and tapering. Beneath it appears a very indistinct trace of a skinny hem. Single small individuals occur at Pinang at all seasons.

|                                      |                       |
|--------------------------------------|-----------------------|
| Breadth of the disk, .....           | 5 $\frac{1}{2}$ inch. |
| From the snout to the anus, .....    | 5 $\frac{1}{2}$       |
| Length of the tail, .....            | 7 $\frac{1}{2}$       |
| From the snout to the mouth, .....   | 1 $\frac{1}{2}$       |
| "    to the eyes, .....              | 1 $\frac{1}{2}$       |
| Breadth of the mouth, .....          | 0 $\frac{1}{2}$       |
| Distance between the eyes, .....     | 0 $\frac{1}{2}$       |
| Length of the posterior spine, ..... | 2                     |

#### TRYGON ZUGEI, Bürger.

*Trygon zugei*, Müller und Henle, 165. Taf.

*Trygon zugei*, Richardson : Report, 1845, 197.

(*Young.*) Above brownish yellow; caudal membranes black; beneath reddish white. Iris golden; pupil transversely oval.

HABIT:—*Sea of Pinang.*

Indian Ocean, Sea of Japan, China.

The snout is very prominent, acute. The anterior margins of the disk are straight, the posterior convex. The external angle of the pectorals is equidistant from the apex of the snout and the anus. The length of the disk slightly exceeds the breadth. The distance between the nostrils and the apex of the snout is contained 3 $\frac{1}{2}$  times in that between the apex and the centre between the nostrils. The distance between the eyes is  $\frac{1}{2}$  of their distance from the point of the snout. The teeth have a transversal keel. The thin tapering tail is double the length of the body. The spine is situated nearly at the anterior fourth of the tail. Behind the spine appear a superior and inferior membrane. Both are low, the inferior longer than the superior. The body is naked, but on the dorsal column, between the occiput and the scapular region, appear 3 distant small thorns. Some distant, very minute thorns appear on the sides of the tail behind the spine. The latter is about  $\frac{1}{2}$  of the length of the tail.

|                                                |                       |
|------------------------------------------------|-----------------------|
| From the apex of the snout to the mouth, ..... | 1 $\frac{1}{2}$ inch. |
| "    mouth to the anus, .....                  | 2 $\frac{1}{2}$       |



|                                                       |                 |
|-------------------------------------------------------|-----------------|
| Length of the tail,.....                              | 9 inch.         |
| Distance between the nostrils, .....                  | $0\frac{1}{16}$ |
| Greatest breadth of the disk,.....:                   | $4\frac{1}{2}$  |
| Distance between the eyes, .....                      | $0\frac{1}{2}$  |
| Breadth of the mouth, .....                           | $0\frac{1}{16}$ |
| Single young individuals occur at Pinang, but rarely. |                 |

GEN. PTEROPLATEA, *Müller und Henle*, 1837.

The disk is nearly or more than twice as broad as long. Tail short, generally shorter than the body, naked or with low fins. Mouth slightly arched. The teeth do not extend to the angles of the mouth; they carry one to three points. The upper membranous valve of the jaw is indistinct, without fringes. No papillæ in the lower jaw. The skin is smooth, or covered with tubercles.

PTEROPLATEA MICRURA, (Bloch-Schn.)

*Trygon micrura*, Bloch-Schn. 300.

Russell, VI. Tenkee Kunsul. (*Young.*)

*Raja poecilura*, Shaw, V. 291.

*Trygon kunsua*, Cuvier, R. A. II. 400 (\*)

*Trygon poecilarus*, Bennett: Life of Raffles, 694.

*Pteroplatea annulata*, Swainson, II. 319.

*Pteroplatea micrura*, Müller und Henle, 169.

*Pteroplatea micrura*, Richardson, Report, 1845, 197.

(*Very young.*) Above reddish- or bluish- brown, with numerous dark dots, or with distant indistinct light spots; beneath bluish- or reddish-white.

(*Older.*) Above bottle-green, or bluish-brown; tail with black and white or rose-coloured rings; beneath whitish. Iris golden, pupil transversely oval.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Bay of Bengal, Mouths of the Ganges, Red Sea, Sumatra, Java, Borneo, China Sea.

The snout is little prominent. The anterior margin of the pectorals is a little longer than the posterior and slightly concave in the middle; the posterior is convex; the external angle is conical, the posterior obtusely rounded. In younger individuals the length of the disk, from the snout

to the anus, is less than one half of the breadth of the disk, or the distance between the external angles of the pectorals. In older individuals the length is  $\frac{2}{3}$  of the breadth of the disk. The distance between the inner angles of the nostrils is about one half of the greatest diameter of the nostril. The distance between the external angles of the nostrils is double the distance from their centre to the point of the snout, or their nearest distance from the pectoral margin. The teeth are tricuspidate; their central cusps are erect and longer than the lateral horizontal ones. In both jaws the teeth are confined to the central third, on each side of which in the upper jaw appears a notch corresponding to a minute prominence in the lower jaw. The depressed tongue occupies the whole breadth of the mouth. The margin of the spiracles carries no denticle. The body is naked. The ventral fins are elongated tetragonal, with the posterior angles rounded. The male appendages project beyond the inner margins of the ventrals, and extend to the root of the caudal spine. The length of the tail varies: in the very young it is shorter than the body, later it becomes a little longer than the body. It is depressed towards the spine, from thence it is cylindrical, very slender and tapering. It has no fins. The slender spine is situated at the anterior fifth. In the young, with the disk upwards of one foot in breadth, it is hidden in the integuments, and scarcely  $\frac{1}{3}$  of the length of the tail. In a male,  $15\frac{1}{4}$  inch in breadth, the spine is nearly  $\frac{1}{3}$  of the length of the tail. The largest individual observed was taken in 1840 near the Island of Lantao, in the mouth of the Canton River; the disk measured 4 feet in breadth, 3 feet in length, and the tail 1 foot. The tail was armed with two spines situated close to each other; each about one inch in length. Single young individuals occur at all seasons in the Straits of Malacca.

#### Dimensions.

|                                                          |                      |
|----------------------------------------------------------|----------------------|
| From the snout to the mouth, .....                       | $1\frac{1}{2}$ inch. |
| From the mouth to the anus, .....                        | $4\frac{1}{2}$       |
| Length of the tail, .....                                | 8                    |
| Distance between the inner angles of the nostrils, ..... | $0\frac{1}{2}$       |
| Greatest diameter of the nostrils, .....                 | $0\frac{1}{2}$       |
| From the snout to the eyes, .....                        | $0\frac{1}{2}$       |
| Distance between the eyes, .....                         | $1\frac{1}{2}$       |
| Breadth of the disk, .....                               | $15\frac{1}{4}$      |

## GEN. HYPOLOPHUS, Müller und Henle, 1837.

Form of the body like *Trygon*. Tail beneath with a fin, not extending to the apex. Upper fin absent. Differs principally from *Trygon* by the peculiar form of the mouth and the teeth. The centre of the lower jaw is pointed and projecting, and has on each side a forwards directed cavity. The margin of the upper jaw is excavated in the centre to receive the point of the lower jaw, and is very convex on each side. Teeth like paving stones, hexagonal, broader than long; in the upper jaw the teeth of the centre are small, those of the sides large; in the lower jaw they are nearly of equal size: the external ones smaller.

## HYPOLOPHUS SEPHEN, (Forskål.)

*Raja sephen*, Forskål: Descr. 17, No. 16.

*Raja sephen*, Lacép. I. 123.

*Raja sephen*, Bl. Schn. 364.

Russell, III. Wolga Tenkee.

*Raja sephen*, Shaw, V. 288.

*Raja sephen*, Var. Shaw V. 289.

*Trygon sephen*, Cuv. R. A. II. 399.

*Trigon sephen*, Rüppell: Atlas, 52.

*Trigon forskålii*, ibid. 53, Taf. XIII. Fig. 2.

*Trigon sephen*, Rüppell: Neue Wirbelth. Fische, 69, Taf. XIX.  
Fig. 5, (Teeth.)

*Hypolophus sephen*, Müller und Henle, 170.

*Hypolophus sephen*, Bleeker: Verh. Bat. Gen. XXII. 6.

(*Young*.) Above reddish brown; the scaly portion of the head, back and tail lead-coloured; tail behind the spine, and caudal fin blackish brown; beneath whitish. Iris golden; pupil transversely oval, black.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Bay of Bengal, Mouths of the Ganges, Red Sea, Indian Ocean, Java, Madura.

The disk is rhombic, with rounded angles. In the very young the snout is more pointed than in the older. The external angles of the ventrals are acute, the internal obtuse. The distance between the nostrils is one half of their distance from the snout. The distance from the snout to the eyes exceeds by one third that between the eyes. The

snout is above covered with distant tricuspidate scales. On the upper part of the head, back and on the root of the tail they are smooth, hexagonal, with their anterior and posterior margins denticulated and with a shallow cavity in their centre. Three large heart-shaped convex plates, placed longitudinally, appear on the scapular region. Of the three the central one is the largest, the anterior the smallest. The tail is from three to four times the length of the body. As far as the spine it is depressed, trigonal and tapering; the portion supporting the caudal is compressed and with minute lanceolate scales; the rest is very attenuated like a whip cord. The spine is situated a little behind the anterior third of the tail; its length varies from  $\frac{1}{2}$  to  $\frac{3}{4}$  of the tail. The caudal membrane commences beneath the root of the spine and continues beyond the central third of the lower margin of the tail. Its height is less than that of the part of the tail to which it is attached. Single young individuals occur at all seasons in the Straits of Malacca.

Dimensions.

|                                                                         |                       |
|-------------------------------------------------------------------------|-----------------------|
| From the snout to the mouth, . . . . .                                  | 1 $\frac{1}{2}$ inch. |
| From the mouth to the anus, . . . . .                                   | 4 $\frac{1}{2}$       |
| Length of the tail, . . . . .                                           | 26 $\frac{1}{2}$      |
| Distance between the inner (anterior) angles of the nostrils, . . . . . | 0 $\frac{1}{2}$       |
| From the snout to the eyes, . . . . .                                   | 2                     |
| Distance between the eyes, . . . . .                                    | 1 $\frac{1}{2}$       |
| Breadth of the disk, . . . . .                                          | 7 $\frac{1}{4}$       |

GEN. TAENIURA, *Müller und Henle*, 1837.

Disk rounded. Tail not much longer than the body, depressed in front of the spine, compressed behind it, with a high inferior fin, which commences from the spine and extends to the apex of the tail. The upper margin of the tail carries frequently a low longer or shorter skinny hem, extending to the apex of the tail. The caudal spine a little in front of the middle of the tail. Nostrils approximated as in *Trygon*. Teeth flattened, with a transversal protuberance, or pointed. Mouth straight or undulating. Membranous valve behind the upper jaw straight; that behind the lower jaw without papillæ.

TAENIURA LYMNA, (Forskål.)

*Raja lymna*, Forskål: Descr. 17, No. 15.

*Raja lymna*, Linné: Syst. 1511.

*Raja lymna*, Lacép. I. Tab. IV. Fig. 2-3.

*Raie torpille*, ibid. Tab. VI. Fig. 1.

*Raja lymna*, Bl. Schn. 364.

*Raja lymna*, Shaw V. 287.

*Trigon lymna*, Rüppell : Atlas, 51, Taf. 13, Fig. 1.

*Trygon lymna*, Cuv. R. A. II. 400 (\*).

*Trigon lymna*, Rüppell : Neue Wirbelth. Fische, 69, Taf. 19.

Fig. 4. (Teeth.)

(Icon.) *Trygon ornatum*, Gray : Ill. Ind. Zool. I. Pl. 99.

*Trygon lymna*, Swainson, II. 319.

*Taeniura halgani*, Lesson in Duperrey : Voy. II. 100.

*Taeniura lymna*, Müller und Henle, 171, 197, Taf. (Month.)

(Young.) Above brownish bronze, with numerous oval and round ultramarine spots; from the scapular region on each side of the back a broad ultramarine band, continuing on the sides of the tail to the root of the spine; caudal fin pale brownish, the lower margin edged with black; beneath greenish white. Iris narrow golden round the pupil, the rest dark blue; pupil transversely oval, black.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Indian Ocean, Red Sea, Timor, New Ireland.

#### Dimensions.

|                                    |          |
|------------------------------------|----------|
| From the snout to the mouth, ..... | 0½ inch. |
| From the mouth to the anus, .....  | 3½       |
| Length of the tail, .....          | 6        |
| „ of the caudal spine, .....       | 1        |
| Distance between the eyes, .....   | 0½       |
| Breadth of the disk, .....         | 4½       |

This species is of rare occurrence in the Straits of Malacca.

#### FAM. MYLIOBATIDIDÆ.

GEN. MYLIOBATIS (Duméril, 1817) Müller und Henle, 1841.

(ÆTOBATIS, Blainville, 1828.)

Snout pointed, composed by the united anterior pectoral rays. Nasal valves united, with straight margin. Mouth transversal. Both jaws with straight margin. Teeth hexagonal, in the centre a series of broader teeth, backwards, increasing in breadth. On each side smaller, tetragonal plates resembling paving stones, fitting into the zig-zags of the central

teeth. The teeth of the upper jaw longitudinally and transversely convex; those of the lower jaw flat, scarcely somewhat concave; teeth of neither jaw occupy the entire breadth.

**MYLIOBATIS NIEUHOFII, (Bloch-Schn.)**

*Aquilæ marinæ* species, Willoughby, 6, Tab. X. Fig. 3 (App.)

*Raja nieuhoii*, Bl. Schn. 364.

Russell, VII. Mookarah Tenkee.

*Raja fasciata*, Shaw, V. 286, Pl. 143.

*Myliobatis nieuhowii*, Cuv. R. A. II. 401 (?).

*Myliobatis aquila*, Bonaparte: Fauna It. Fasc. II.

*Myliobatis nieuhoii*, Müller und Henle, 177.

*Myliobatis nieuhoii*, Richardson: Report, 1845, 198.

Pari klawar of the Malays.

(*Young.*) Above yellowish brown, with six or more narrow transverse bands of deep bluish purple; beneath whitish; tail blackish brown; posterior half with irregular white spots. Iris golden, pupil vertically elliptical. Teeth pale amber-coloured.

**HABIT.**—*Sea of Pinang.*

Indian Ocean, Coromandel, Chinese and Australian Seas, Mediterranean.

In the very young the apex of the snout is double the length of the nasal valve. The pectorals are sickle-shaped. The dorsal is triangular, commencing at the root of the tail, and not extending beyond the apex of the ventrals. The length of the body is contained  $2\frac{3}{4}$  times in the greatest breadth of the disk. The body is naked, and the tail without spine. The tail exceeds four times the length of the body. A female, observed at Pinang in May 1845, was of the following dimensions.

|                                                                         |                      |
|-------------------------------------------------------------------------|----------------------|
| From the snout to the mouth,.....                                       | $0\frac{5}{8}$ inch. |
| „ mouth to the anus,.....                                               | $2\frac{3}{4}$       |
| Length of the tail,.....                                                | $14\frac{1}{2}$      |
| From the root of the tail to the dorsal,.....                           | $0\frac{3}{4}$       |
| From the snout to the eyes,.....                                        | $0\frac{1}{2}$       |
| Distance between the eyes,.....                                         | $0\frac{1}{4}$       |
| Breadth of the nasal valve,.....                                        | $0\frac{1}{4}$       |
| Length of do.....                                                       | $0\frac{1}{2}$       |
| Greatest breadth, (between the external angles of the pectorals,) ..... | $8\frac{1}{2}$       |

## MYLIOBATIS MILVUS, Valenciennes.

*Myliobatis milvus*, Müller und Henle, 178.

Pari klawar of the Malays.

(*Young.*) Above, pale fawn-coloured; on the head and back a number of distant anastomosing black lines, which on the anterior half of the root of the pectorals are arranged transversely, so as to make the ground-colour between them resemble very broad transverse bands; on the rest of the body, on the pectoral and ventral fins the black lines form an open net-work; the anterior margin of the pectorals, to near the apex, and the dorsal, pale fawn-coloured without black meshes. Anterior sixth of tail fawn-coloured, indistinctly ringed with blackish brown; rest of the tail black; abdomen white. Iris narrow golden round the pupil, the rest fawn-coloured; pupil heart-shaped, with the apex downwards. Teeth pale amber-coloured.

HABIT.—*Sea of Pinang.*

Red Sea.

The form of the body, teeth and fins is similar to that of *M. nieuhofii*, but the position of the dorsal fin differs. It commences farther behind the termination of the base of the ventrals, close to their apex, beyond which it does not extend. The male appendages are shorter than the corresponding margin of the ventrals; they are white, with a black longitudinal streak above. At its root the tail is greatly compressed, two edged, like the blade of an oar; the rest is slender like a whipcord; its length is  $4\frac{1}{2}$  times that of the body. The tail has neither spine nor fin. The body is naked. A single young male was observed at Pinang in August 1846. It was of the following dimensions:

|                                                      |                      |
|------------------------------------------------------|----------------------|
| From the snout to the mouth, . . . . .               | $1\frac{2}{3}$ inch. |
| „ mouth to the anus, . . . . .                       | $6\frac{2}{3}$       |
| Length of the tail, . . . . .                        | $46\frac{2}{3}$      |
| „ from the root of the tail to the dorsal, . . . . . | $1\frac{1}{2}$       |
| Base of the dorsal, . . . . .                        | $0\frac{2}{3}$       |
| Anterior margin of do., . . . . .                    | $0\frac{2}{3}$       |
| Posterior margin of do., . . . . .                   | $0\frac{2}{3}$       |
| Distance between the eyes, . . . . .                 | $1\frac{5}{8}$       |
| Distance between the nostrils, . . . . .             | $0\frac{7}{8}$       |
| Breadth of the mouth, . . . . .                      | $0\frac{2}{3}$       |
| Anterior margin of the pectorals, . . . . .          | $9\frac{1}{8}$       |

|                                                                                       |          |
|---------------------------------------------------------------------------------------|----------|
| Posterior margin of the pectorals, .....                                              | 7½ inch. |
| Base of the ventrals, .....                                                           | 0½       |
| External margin of do., .....                                                         | 1½       |
| Internal do., .....                                                                   | 1½       |
| Male appendage, .....                                                                 | 0½       |
| Greatest breadth of the disk (between the external angles<br>of the pectorals,) ..... | 19       |

GEN. STOASODON,\* *Cantor.*(Equivalent to *Aëtobatis*, Müller und Henle, 1841.)

Snout acute, undivided. The lower margin of the united nasal valves deeply indented. The frænulum of the nasal valve is covered with papillæ which are transversely disposed in front of the upper jaw. On the dorsal surface of the nasal valve, near the external margin, a lobule with fringed edge. Lower jaw acute, projecting beyond the upper; upper jaw with a straight margin. The dental laminæ of both jaws form a series, without smaller lateral teeth; in the lower jaw the laminæ are arched and parallel to the margin of the jaw. The laminæ do not occupy the whole breadth of the jaw.

## STOASODON NARINARI, (Bloch-Schneider.)

Narinari, Marcgrave, 176.

Ruysch: Thes. T. XXXIX. Fig. 6.

La raie aigle, Lacép. I. Pl. 6, Fig. 2.

Raja narinari, Bloch-Schn. 361.

Russell, VIII. Eel-tenkee.

Raja guttata, Shaw, V. 285, Pl. 142.

Raja quinqueaculeata, Quoy et Gaim. Freycin. 200, Pl. 43, Fig. 3.

Myliobatis narinari, Cuv. R. A. II. 401 (°)

Myliobatis narinari, Bennett: Life of Raffles, 694.

Myliobatis eel-tenkee, Rüppell: Neue Wirbelth. Fische, 70, Taf. 19,  
Fig. 3, (Teeth.)*Aëtobatis indica*, Swainson, II. 321.

\* *Στοά*, arcade; *ὀδόν*, tooth. Substituted for *Aëtobatis*, Müller und Henle, 1841, preoccupied by *Aëtobatis*, Blainville, 1828, which as observed, is a synonyme of *Myliobatis*. The characters given are those of M. M. Müller and Henle.



*Myliobatis narinari*, Agassiz : III. Taf. D. 1, 2. (Teeth.)

*Myliobatis macroptera*, McClelland : Calc. Journ. Nat. Hist. 1. 60,

Fig. 1, a. b.

*Aëtobatis narinari*, Müller und Henle, 179.

*Aëtobatis narinari*, Bleeker : Verh. Batav. Gen. XXII. 6.

Pari lung of the Malays.

Above greenish olive or greenish grey ; a little behind the occiput and behind the anterior margin of the pectorals appear more or less numerous greenish-white rounded spots, edged with black ; tail behind the spine black ; abdominal surface of disk and tail as far as the spine greenish white ; rest black. Iris greenish golden ; pupil vertically elliptical. Teeth greenish white.

**HABIT.**—*Sea of Pinang, Malayan Peninsula, Singapore.*

Indian Ocean, Red Sea, Bay of Bengal, Mouths of the Ganges, Sumatra, Java, Madura, Brazil, Surinam.

**GREATEST BREADTH :** 3 feet.

The snout is conical and about  $\frac{1}{2}$  broader than long, and not quite double the length of the nasal valve. The nasal lobule is broad conical. The shape of the disk resembles that of *Myliobatis milvus*. The dorsal fin commences near the termination of the base of the ventrals, but terminates at some distance in front of the apex of the ventrals. The latter are elongated, about thrice as long as broad. The male appendages do not extend beyond the corresponding margin of the fin, and are shorter in the young. The tail is trigonal as far as the spine, the rest is compressed and flagelliform. Its length is thrice or four times that of the body. The spine is situated immediately behind the termination of the dorsal ; its length equals its distance from the anus. Some individuals are armed with a second somewhat longer spine, a little behind the root of the former. The dental laminae of the upper jaw are very slightly arched ; the anterior margin of the external laminae exhibits numerous vertical denticulations. The laminae of the lower jaw are but  $\frac{2}{3}$  of the breadth of those of the upper, but they are more convex, forming in the centre an obtuse angle. Single young individuals occur at all seasons in the Straits of Malacca. The following dimensions were taken from a young male, armed with two spines :

From the snout to the nostrils, . . . . . 1 inch.

From the nostrils to the mouth, . . . . .  $0\frac{1}{4}$

|                                            |                       |
|--------------------------------------------|-----------------------|
| From the mouth to the anus, .....          | 5 $\frac{1}{2}$ inch. |
| Length of the tail, .....                  | 33 $\frac{3}{4}$      |
| Distance between the nostrils, .....       | 0 $\frac{1}{2}$       |
| "    "    the eyes, .....                  | 1 $\frac{1}{4}$       |
| Breadth of the mouth, .....                | 0 $\frac{1}{2}$       |
| Distance from the snout to the eyes, ..... | 1 $\frac{1}{2}$       |
| Length of the anterior spine, .....        | 1 $\frac{1}{2}$       |
| "    of the second do., .....              | 1 $\frac{1}{4}$       |
| Greatest breadth of the disk, .....        | 11 $\frac{1}{2}$      |

GEN. RHINOPTERA, (*Kuhl*) *Müller und Henle*, 1841.

The snout deeply divided by a central incision. The cranial fins are not on a level with the pectorals, but lower down, and are fixed at the inferior margin of the root of the pectorals. The rays of the cranial fins commence farther back than the termination of the pectorals. The lower margin of the nasal valve is straight; the external angle acute; on each side of their dorsal surface a longitudinal fold. The teeth stand side by side in 3 to 5 rows of broad hexagonal plates which laterally decrease in size. Outside appear several rows of smaller teeth, which are not broader than long. They occupy the entire breadth of the jaw.

RHINOPTERA ADSPERSA, Valenciennes.

*Rhinoptera adpersa*, Müller und Henle, 183.

Pari daun of the Malays.

(*Young.*) Above pale fawn-coloured; beneath white.

(*Older.*) Above chocolate brown or greenish olive; beneath white.

Iris golden fawn-coloured; pupil vertically elliptical. Teeth yellowish white.

HABIT.—*Sea of Pinang.*

Indian Ocean.

The teeth of both jaws are similar; those of the centre-row are hardly thrice as broad as long. The other rows gradually decrease towards the sides of the mouth. There are nine rows in the upper jaw, seven in the lower. The margin of the nasal valve is finely denticulated, its length is 3 $\frac{1}{2}$  times its height. The anterior margin of the pectorals is slightly convex; the posterior concave; the angles

acute. The ventrals are tetragonal, considerably projecting beyond the pectorals. The dorsal commences at the termination of the ventrals, and extends a little beyond their apex. The tail is about 3 to  $3\frac{1}{2}$  times the length of the body; the anterior third is greatly compressed; the rest flagelliform. At a short distance from the dorsal is situated a small spine, but little longer than the base of the dorsal; a little behind it appears a second, scarcely longer than the preceding spine. In the young the back is smooth. In older individuals M. M. Müller und Henle describe the back as being rough from minute spines with stellate base. At Pinang this species occurs at irregular intervals, singly or a few together. The following dimensions were taken from a young female.

|                                                                          |                |
|--------------------------------------------------------------------------|----------------|
| From the incision of the snout to the centre between the nostrils, ..... | 1 inch.        |
| „ the nostrils to the mouth, .....                                       | $0\frac{2}{3}$ |
| „ the mouth to the anus, .....                                           | $5\frac{1}{8}$ |
| Length of the tail, .....                                                | 24             |
| Breadth of the margin of the nasal valve, .....                          | $1\frac{1}{8}$ |
| „ of the mouth, .....                                                    | $1\frac{1}{8}$ |
| „ of the disk, .....                                                     | 13             |
| Length of the posterior margin of the pectorals, .....                   | $0\frac{7}{8}$ |
| „ of external margin of the ventrals, .....                              | $1\frac{2}{3}$ |
| „ of each caudal spine, .....                                            | $0\frac{1}{4}$ |

#### FAM. DICEROBATIDIDÆ.

GEN. DICEROBATUS, (DIAROBATUS, Bloch,) Blainville, 1828.

(CEPHALOPTERUS,\* [Duméril,] Risso, 1810.—CEPHALOPTERA, Risso, 1826.)

Mouth on the abdominal surface. Teeth of both jaws minute, flattened, like paving stones, of different forms. The rays of the pectorals extend closely to the skull. The anterior margin of the pectorals is convex from the skull behind the eyes to the apex.†

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\* Pre-occupied by *Cephalopterus*, Geoffroy, 1809, (*Aves*.)

† *Cephaloptera*, Müller und Henle, page 184.

## DICEROBATIS EREGOODOO, (Cuvier.)

Russell : page 5, No. IX. Eregoodoo Tenkee. R. (Dorsal view.)


Cephaloptera eregoodo-tenkee, Cuv. R. A. II. 402 (').

(*Young ?*) Above intense purple, with blue and violet reflections ; at the apex of the dorsal fin a whitish rounded spot ; external margin of ventrals white ; upper (external) surface of the cranial fins, and side of the head behind the eyes white ; lower (internal) surface of the cranial fins silvery grey, of a chequered appearance, produced by the transverse divisions of the rays ; the apex and internal margin broadly brimmed with black ; beneath white ; tail, as far as the ventrals extend, white, rest black ; margin of the snout and both jaws black. Iris purple ; pupil vertical, resembling the figure 8, or two vertically placed balls.

HABIT.—*Sea of Pinang.*

Coromandela

The inner half of the anterior margin of the pectorals is very slightly concave, the outer half convex ; the posterior margin is concave ; the external and internal angles acute. The length of the pectorals, from their origin, above and a little behind the eye, to their internal angle, is about  $\frac{2}{3}$  of the greatest breadth of the disk. The ventrals project but little beyond the pectorals. The male appendages are about  $\frac{2}{3}$  of the internal margin of the ventrals, slender and throughout attached to the margin. The tail slightly exceeds  $1\frac{1}{2}$  times the length of the body ; it is very slender, flagelliform, and nearly throughout tetragonal. The dorsal fin has the appearance of being triangular, but it has a posterior very short margin. It commences a little in front of the ventrals and terminates a little behind their termination. The apex of the dorsal hardly extends beyond the anterior half of the ventrals. The body is smooth to the touch. The upper surface of the head and the throat are perforated by numerous pores. At the posterior part of the back appear some very minute scales or spines, which resemble white dots. They are distant and offer no resistance to the touch. The tail is naked and without spine. The anterior margin of the head (the snout), between the cranial fins, is concave. The distance from the centre of this margin to the mouth is  $\frac{1}{3}$  of the breadth of the mouth. The length of the cranial fins, from their origin a little behind the mouth to their apex, equals the distance between both fins

across the throat. Both are parallel, not diverging, as they appear in M. M, Müller and Henle's figure of *Cephaloptera kuhlii*. They are turned upwards, their upper surface being longitudinally hollowed. The spiracles are very small, hid beneath the origin of the pectorals. The margin of the nasal valve is straight and covers nearly the whole of the upper jaw. The angles form a conical lobule. The narrow band of teeth extends in both jaws not quite to the angle, occupying the central  $\frac{1}{4}$  of the breadth of the mouth. The teeth are uniformly minute, flattened, of a pentagonal shape, with backwards directed point. They have frequently two or three such points. They are generally twice broader than long, but in both jaws appear here and there a single tooth broader than the rest, as if composed of two or three teeth soldered together. The upper jaw has 80, the lower 95 rows of teeth, each consisting of 6, rarely 7. Behind the upper jaw appears a large membranous valve, the free margin of which is convex. There is no trace of a tongue. The equidistant gill-openings are arranged on two backwards converging lines. Each opening is of this figure , the first being double the length of the fifth. The only individual examined, was observed at Pinang in February 1845. It was a male, apparently young, of the following dimensions.

From the centre between the cranial fins to the centre of

|                                                  |                       |
|--------------------------------------------------|-----------------------|
| the snout, .....                                 | 3 $\frac{1}{8}$ inch. |
| From the centre of the snout to the mouth, ..... | 1 $\frac{1}{8}$       |
| „ the mouth to the anus, .....                   | 11                    |
| Length of the tail, .....                        | 19 $\frac{3}{8}$      |
| Distance between the nostrils, .....             | 2 $\frac{1}{8}$       |
| „ from the nostrils to the mouth, .....          | 0 $\frac{5}{8}$       |
| Breadth of the mouth, .....                      | 3 $\frac{5}{8}$       |
| Length of the cranial fins, .....                | 5 $\frac{3}{8}$       |
| Distance between them, .....                     | 5 $\frac{3}{8}$       |
| „ between the eyes, .....                        | 5                     |
| Base (Length) of the pectorals, .....            | 13 $\frac{3}{8}$      |
| Breadth of do., .....                            | 13 $\frac{1}{4}$      |
| Base of the dorsal, .....                        | 1 $\frac{5}{8}$       |
| Anterior margin of do., .....                    | 2 $\frac{1}{8}$       |
| Posterior „ of do., .....                        | 0 $\frac{3}{8}$       |
| Superior „ of do., .....                         | 0 $\frac{7}{8}$       |

|                                                 |                       |
|-------------------------------------------------|-----------------------|
| Length of the ventrals,.....                    | 2 $\frac{1}{2}$ inch. |
| „ „ „ first gill-opening, .....                 | 1 $\frac{1}{4}$       |
| „ „ „ fifth do., .....                          | 0 $\frac{1}{2}$       |
| Distance between the first gill-openings, ..... | 3 $\frac{1}{2}$       |
| Greatest breadth of the disk,.....              | 30 $\frac{1}{2}$      |

The stomach is elongated cylindrical, half the length of the body ; the intestines equal the length of the body.

This fish agrees in several characters with Russell's *Eregoodoo Ten-kee*, No. IX. R, (not No. IX. N, from St. Helena.) M. M. Müller and Henle express some doubt as to the identity of Russell's No. IX and *Cephaloptera olfersii*, Müller, (*Plagiostomen*, page 185) from Brazil. According to the description of M. M. Müller and Henle, the latter differs from the present species in the following characters. In *C. olfersii* the distance of the mouth from the head is in proportion to the breadth of the mouth as 3 to 13 ; in the present species that distance is  $\frac{1}{2}$  of the breadth of the mouth, or as 1 to 3. In *C. olfersii* the length of the cranial fins compared with their distance is as 8 to 11 ; in the present species both are equal. In *C. olfersii* the length of the pectorals, measured from their origin on the skull, equals half the breadth of the disk ; in the present species their length is less than the breadth of the disk.

## ADDENDA.

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The following alterations are made by referring to *Histoire Naturelle des Poissons*, Tome XXII. and to *Neue Wirbelthiere. Fische*.

Page 1253.

*Saurus trachinus*, Temminck et Schlegel, is the young of:

SAURUS MYOPS, (Forster.)

Lagarto, Parra, XVIII. Fig 2?

*Salmo foetens*,\* Bloch, Tab. 384, Fig. 2.

*Osmère gallonné*, Lacép. V. Pl. 6, Fig. 1.

*Salmo myops*, Forster, Bl. Schn. 421.

*Salmo truncatus*, Spix et Agassiz : Esp. et Gen. XLV.

*Saurus myops*,

*Saurus truncatus*, } Cuvier : R. A. II. 314 (').

*Saurus lemniscatus*, (*S. elegans*, Gray,) Richardson, Report, 1845,  
301.

*Saurus trachinus*, Temm. et Schl. Fauna Japon. Pisces, 231, Tab.  
CVI. Fig. 2. (*Young*.)

*Salmo myops*, Forster : Descr. Anim. ed. Lichtenstein, 412, No. 303.

*Saurus fasciolatus*, Lesueur, Cuv. and Val. XXII. 489.

*Saurus myops*, Cuv. and Val. XXII. 485.

HABIT.—*Sea of Pinang*.

Indian Ocean, Trincomallee, Pondicherry, Celebes, Amboyna, Sea of China, Macao, Japan, Atlantic Ocean, St. Helena, Isle of France, Martinique, South Carolina, Bahia, Brazil. (Cuv. and Val. l. c.)

Page 1256.

To the Synonymes of *Saurus nehereus*, (Buchan. Hamilton,) add :  
*Saurus ophiodon*, Cuv. and Val. XXII. 490.

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\* Not *Salmo foetens*, Linné (Cuv. et Val. XXII. 488.)

## Page 1252.

*Saurus badi*, Cuvier, belongs according to M. Valenciennes to a distinct genus, following that of *Saurus*, and M. Valenciennes has corrected the nomenclature as follows.

## SAURIDA, Cuvier and Valenciennes, 1849.

The palatals have on the inner side of the long band of teeth a small distinct group of sharp teeth, surrounded by minute asperities. The palatals consequently have two separate series of teeth, whereas in the genus *Saurus* they have but a single such. The internal ventral rays are not so elongated as those of *Saurus*; two oblong foosets on the sides of the palatals, but none in front of the velum palatinum, like those of *Saurus*.

## SAURIDA TUMBIL, (Bloch.)

*Salmo tumbil*, Bloch, Tab. 430.

Russell: CLXXII. Badi Mottah.

*Salmo tumbil*, Shaw, V. 67.

*Saurus badi*, Cuv. R. A. 314 (').

*Saurus badimottah*, Rüppell: Neue Wirbelth. Fische, 77.

*Saurus argyrophanes*, Richardson, Report 1845, 302.

*Saurida tombil*, Cuv. and Val. XXII. 500.

HABIT.—*Sea of Pinang, Malayan Peninsula, Singapore.*

Malabar, Coromandel, Vanikolo, Waigiou, Macao, Red Sea, Isle of France (Cuv. and Val. l. c.)

## Page 1381.

To the Synonymes of *Carcharias acutus* add: Rüppell: Neue Wirbelth. Fische. 65, Taf. 18, Fig. 4.

## Page 1382.

To the Synonymes of *Carcharias melanopterus* add: Rüppell: Neue Wirbelth. Fische. 63.

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## EXPLANATION OF THE PLATES.

### PLATE I.

- Fig. 1. *CRENIDENS SARISSOPHORUS*. Natural size.  
 2. Tooth of the anterior series, upper jaw. Magnified.  
 3. Ditto of the posterior series, Ditto. Ditto.  
 4. Vertical section. Natural size.

### PLATE II.

- Fig. 1—3. *MACROPODUS PUGNAX*. Natural size.  
 2. Labyrinth. Natural size.  
 3. Vertical section. Natural size.  
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- CHÆTODON PRÆTEXTATUS*. Natural size.

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- Fig. 1. *ACANTHURUS XANTHOPTERUS*. Natural size.  
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 4. Scale. }

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- Fig. 1. *OPHIURUS BACCIDENS*. Dentition. Natural size.  
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- Fig. 1. SYMBRANCHUS CALIGANS. Natural size.  
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## PLATE XI.

- Fig. 1. HIPPOCAMPUS MANNULUS. Natural size.  
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## PLATE XII.

- Fig. 1. TEMERA HARDWICKII. (*Young male.*) Natural size.  
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## PLATE XIII.

- Fig. 1. CORYTHOBATUS ECHINATUS. Natural size.  
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- RHINOBATIS LIGONIFER. (*Young male.*) Natural size.
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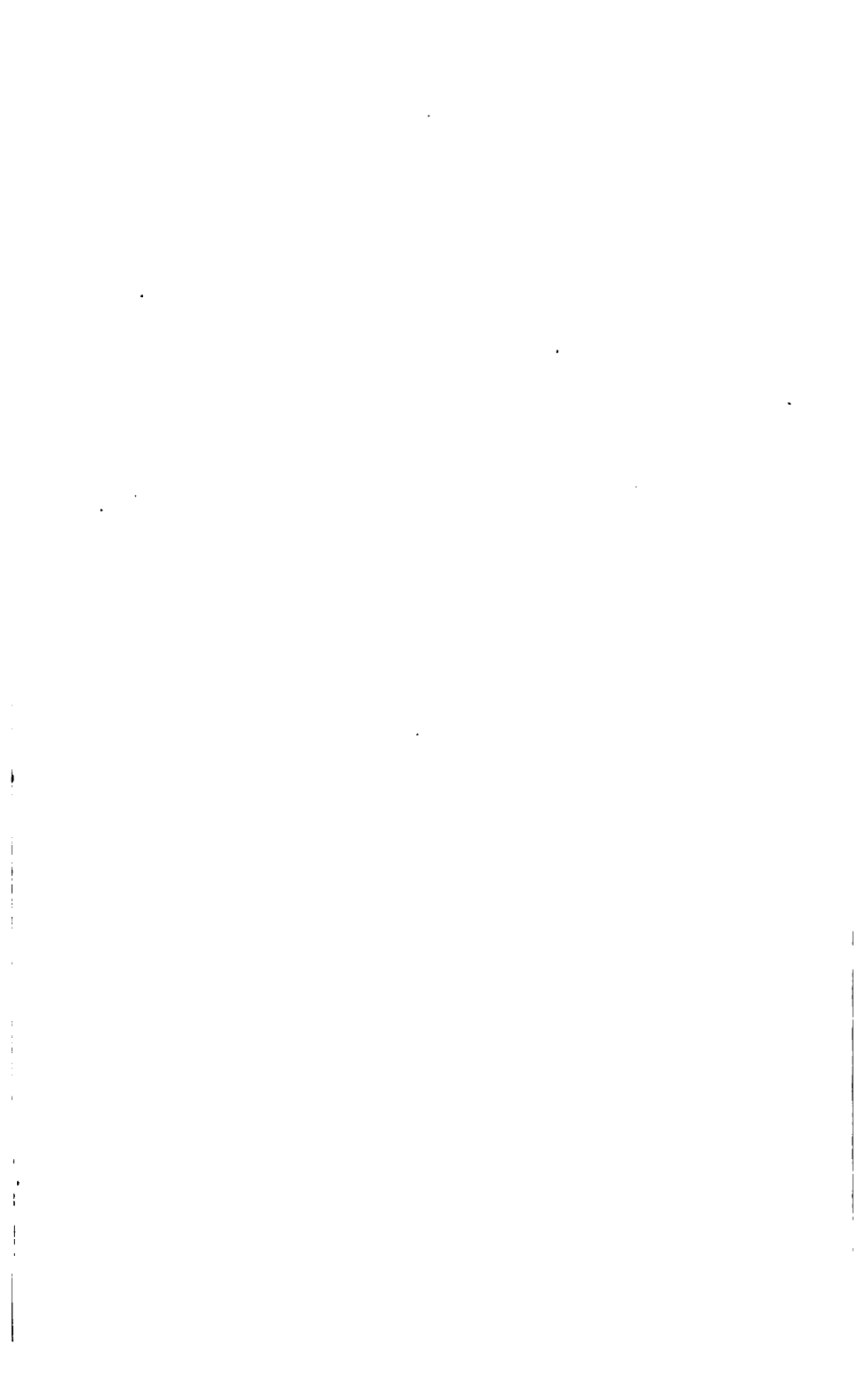
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| <i>jaculator</i> , .....         | 1158. | UMBRINA, .....                    | 1052.       |



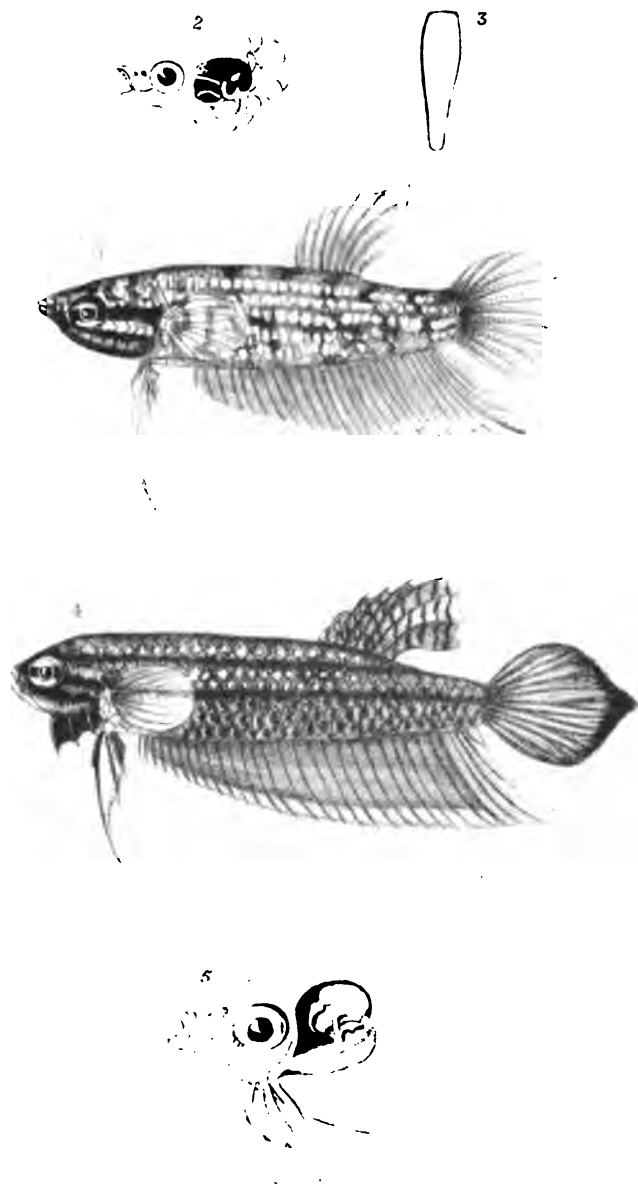


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Fig. 1-3 MACROPODUS PUGNAX. 4. VAR.  
5 TRICHOPODUS TRICHOPTERUS.



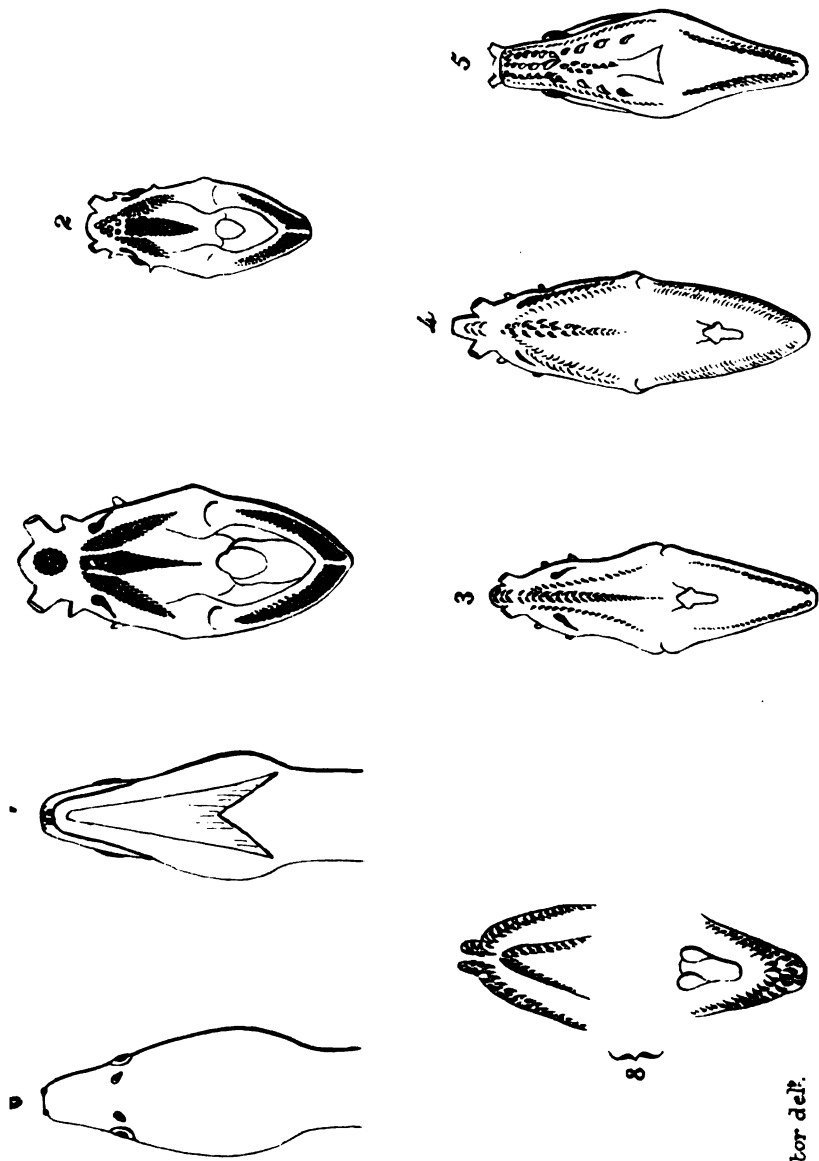








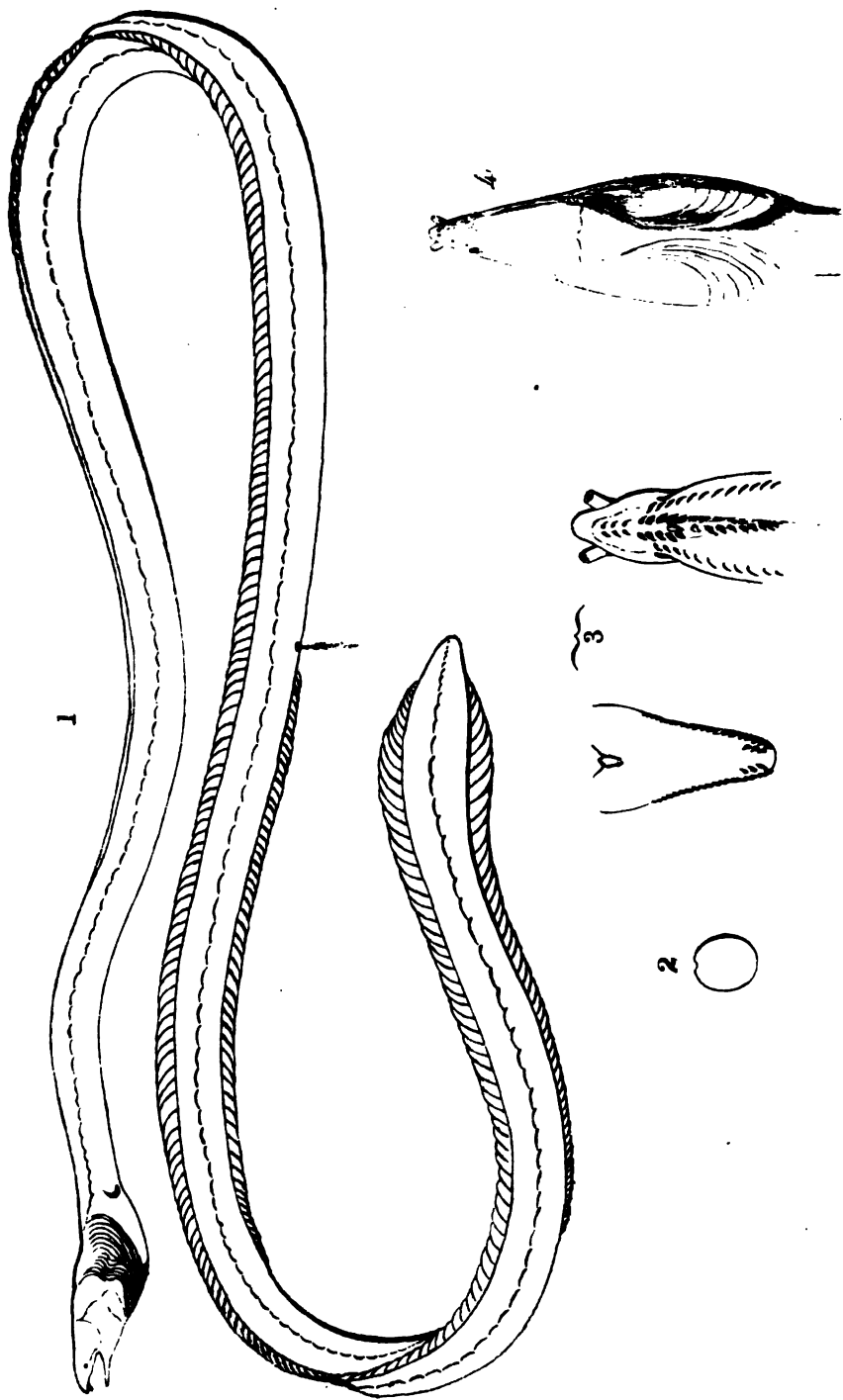




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1. OPHIURUS BACCIDENS. 2. O. BORO. 3. O. GRANDOCULIS. 4. O. BREVICEPS. -  
5. MURÆNA THYRSOIDEA. 6-8. MONOPTERUS JAVANICUS.





T. Cantor del.

DALOPHIS ANCEPS.







Dr. Cantor del.

SYBRANCHUS CALIGANS.



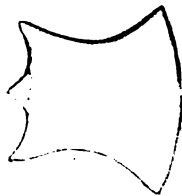
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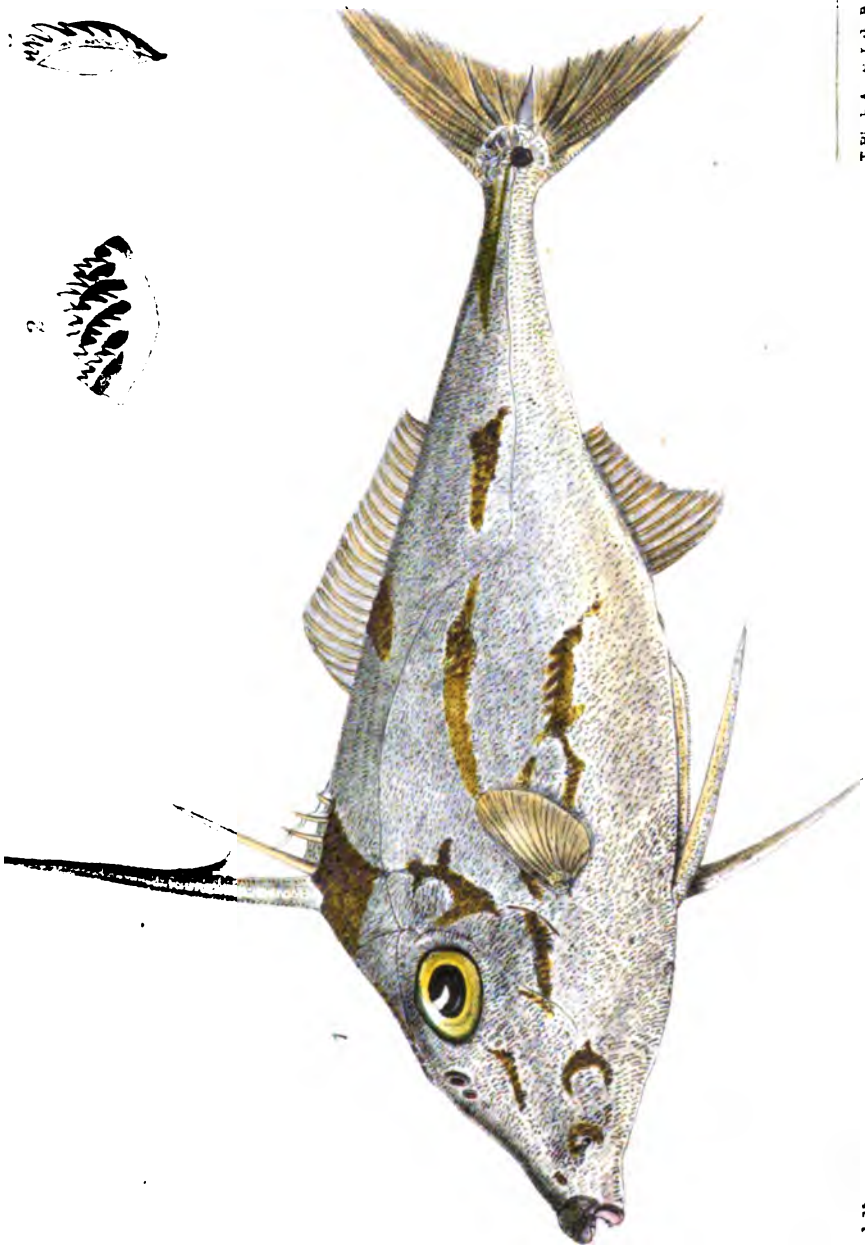
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Fig. 1. ALUTARIUS BARBATUS. 2-3 OSTRACIUM TESSERULA.





T. Cantor, del.

TRIACANTHUS STRIGILIFER

T. Black, Anatic Lith. Press, Calcutta





T. Cantor, del.

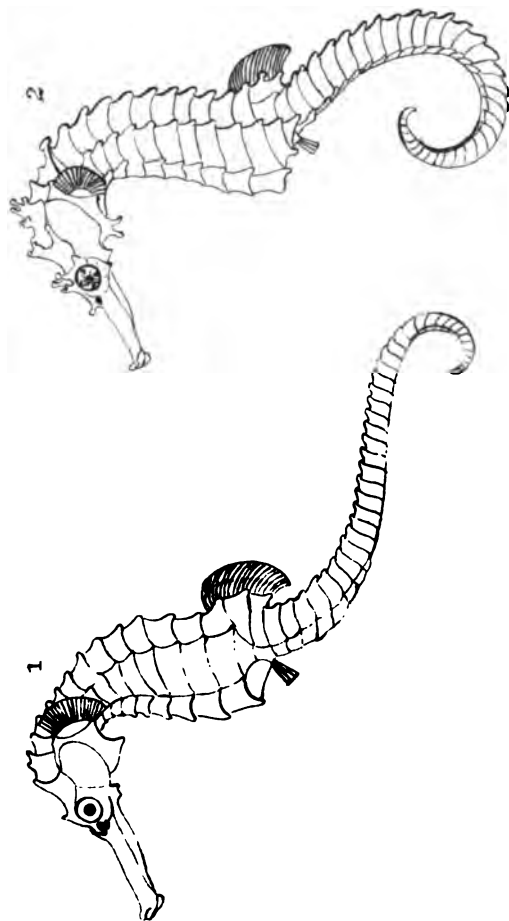
TETRODON NARITUS  
(JUN.)

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T. Black. Asiatic Lark. Penn. Calcutta.



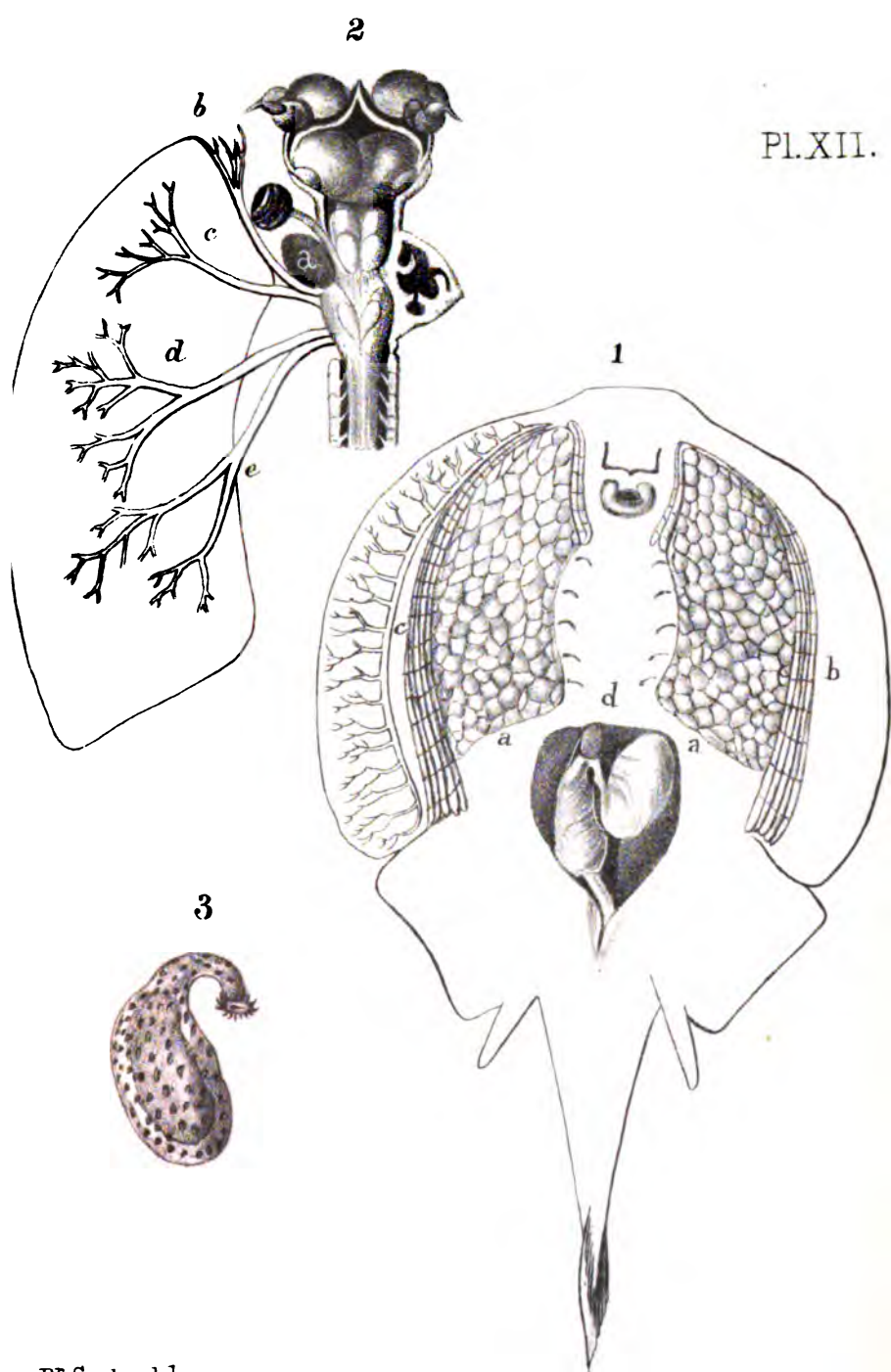




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1. HIPPOCAMPUS MANNULUS. 2. H. COMES.

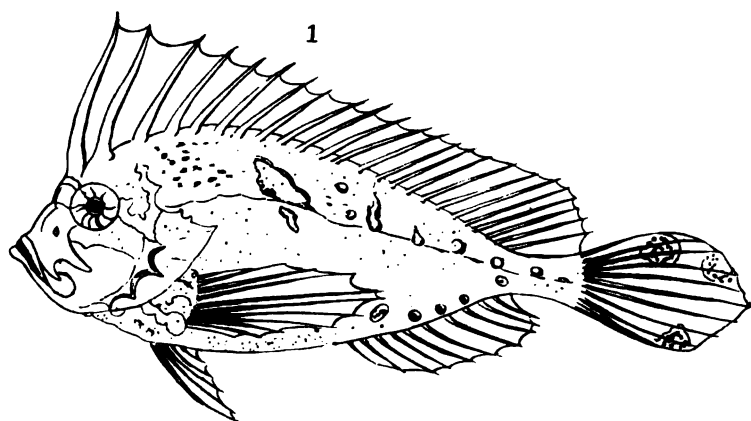




D<sup>r</sup> Cantor del.

Fig. 1-2. TEMERA HARDWICKII.  
Fig. 3. CYSTOCERCUS TEMERÆ.





Cantor del.

CORYTHOBATUS ECHINATUS.





Pl. XIV.





# JOURNAL OF THE ASIATIC SOCIETY.

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OCTOBER. 1849.

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## CATALOGUE OF MALAYAN FISHES.

BY

THEODORE CANTOR, *Esq. M. D. Bengal Medical Service.*

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The following Catalogue of Fishes is the result of observations made during an official residence of three years and a half in Prince of Wales Island (Pulo Pinang), and during visits to Province Wellesley, Malacca, the Lankavy Islands\* and Singapore. The fishermen supplying the markets of Pinang and Singapore are principally natives of China, of whom numbers in search of work annually arrive in Chinese junks. In the course of time four or five commonly join and lay out their savings in boat materials, nets and fishing stakes. The fishing boats vary from one to three tons burden; they are of a slight make and calculated to ply at but short distances from the shore. They are pulled by oars, and seldom carry sails. The nets are made of twine, tanned with bark of Mangrove. The bamboo fishing-stakes are clumsy contrivances. That they answer well enough in fine weather is more owing to the riches of the sea and their sheltered position, than to the ingenuity of the contrivance or the durability of the materials. In nautical skill the Chinese fishermen of the Straits Settlements are far behind the Malays. Although originally a sturdy race, their morals and frames suffer from the consequences of opium-smoking, gambling and the concomitant

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\* A group of Islands on the West Coast of the Malayan Peninsula. (6° N. L.)

vices. Their trade exposes these men to little exertion or hardship, and the greater part of their time is spent idly, if not viciously, on shore. Contrary to their countrymen in general, the Chinese fishermen are considered the least desirable class of settlers. The fishmongers are also natives of China, but they form a class far superior to the fishermen. Their trade comprises the following branches, viz.

1. Fresh Fish.
2. Dried Fish.
3. Isinglass (Fish-Maws).
4. Fish-Roes.
- 5, 6. Red Fish and "Sardines."
7. Sharks' Fins.
8. Baláchan.
9. Fish Manure.
10. Tripang.

1. **FRESH FISH.** The fishermen dispose of their boat loads to the fishmongers who assort the different kinds in heaps, over which seawater is continually poured, and from these the daily customers are supplied. Although comparatively few kinds of fishes appear on the tables of Europeans, the Malays and Chinese are less nice in their selection, and reject but very few kinds.

2. **DRIED FISH.** The daily surplus of fishes is cured by the fishmongers. The process commences with a partial abrasion of the scales, after which the larger fishes are opened lengthwise, and the intestines removed. Water is repeatedly poured over the fishes till blood and impurities have disappeared, when they are placed in casks in flat layers, between which is thrown a quantity of salt. In this state the fishes remain from 24 to 48 hours, when they are exposed to the sun, and frequently turned, till they are thoroughly dried. The smaller kinds are not opened, nor are they all salted before drying in the sun. The little care bestowed upon the curing appears, however, to be sufficient for local consumption, and none of our Settlements in the Straits export dried fishes. The Pikul\* sells from 3 to 7 Spanish Dollars.†

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\* The Pikul of 100 Katties equals 133½ lbs ; the Katty 1½ lb.

† The Spanish Dollar is about 4s. 6d.

3. ISINGGLASS, FISH-MAWS, (*Palongpong ikan* or *ari ari ikan* of the Malays, *loo-pa* of the Chinese) appear to have formed an article of exportation from the islands of the Indian Archipelago as early as they became visited by the Chinese. When these people commenced to settle in the Straits, they not only there collected fish-maws, but also from distant localities. Bombay, Ceylon, Madras, Bengal, Tenasserim, and most of the Malayan Islands contribute to the annual supply, which is bought up by Chinese dealers at Pinang, Malacca and Singapore. By them the maws are exported to China. The fact was noted by Mr. Crawford, but that the fish-maws are isinglass, appears to be the discovery of an anonymous correspondent in Parbury's *Oriental Herald* for January 1839. The personal exertions of Mr. McClelland have been mainly instrumental in adding isinglass to the articles of exportation from India to the European markets.

Since 1842, Mr. W. T. Lewis, Asst. Resid. Counsellor of Pinang, has made some very successful attempts to improve the production of isinglass in Prince of Wales Island. But European merchants there appear unwilling to engage in this novel branch of commerce, as the supply from want of proper care is uncertain, and procurable but in comparatively small quantities. These, however, are no objections to the Chinese dealers, as they are sure of a profitable and quick return of their outlay. The fishes from which isinglass is obtained at Pinang are :

*Lates heptadactylus*, (*Ikan siyakup*,) page 983.

*Polynemus indicus*, (*Ikan kúrow*,) p. 1011.

*Otolithus biauritus*, (*Ikan salámpai*,) p. 1039.

*Otolithus ruber*, (*Jarang gígi*,) p. 1041.

*Otolithus argenteus*, (*Jarang gígi*,) p. 1043.

*Otolithus maculatus*, (*Jarang gígi*,) p. 1044.

*Johnius diacanthus*, (*Ikan tambaréh*,) p. 1049.

*Lobotes erate*, (*Ikan bátu*,) p. 1062.

*Arius truncatus*, (*Ikan salúdu*,) p. 1238.

*Arius arius*, (*Ikan salúdu*,) p. 1240.

*Arius militaris*, (*Ikan salúdu*,) p. 1241.

The annexed Table, exhibiting the quantity of isinglass imported into and exported during 10 years from Pinang to China, has been communicated by Mr. W. T. Lewis.

**QUANTITIES AND VALUE OF FISH-MAWS IMPORTED INTO AND EXPORTED FROM PRINCE OF WALES ISLAND, FROM 1832 TO 1842.**

| IMPORT. |                               |                             | EXPORT. |                               |                             |
|---------|-------------------------------|-----------------------------|---------|-------------------------------|-----------------------------|
|         | Quantity in<br><i>Pikuls.</i> | Value in<br><i>Dollars.</i> |         | Quantity in<br><i>Pikuls.</i> | Value in<br><i>Dollars.</i> |
| 1832-33 | 163                           | 6,113                       | 1832-33 | 182                           | 8,190                       |
| 1833-34 | 103                           | 4,795                       | 1833-34 | 170                           | 7,036                       |
| 1834-35 | 126                           | 4,671                       | 1834-35 | 224                           | 7,835                       |
| 1835-36 | 76                            | 2,970                       | 1835-36 | 172                           | 1,610                       |
| 1836-37 | 135                           | 4,775                       | 1836-37 | 184                           | 7,035                       |
| 1837-38 | 120                           | 4,055                       | 1837-38 | 202                           | 7,875                       |
| 1838-39 | 103                           | 5,118                       | 1838-39 | 204                           | 9,140                       |
| 1839-40 | 71                            | 3,034                       | 1839-40 | 192                           | 7,299                       |
| 1840-41 | 309                           | 10,227                      | 1840-41 | 144                           | 5,299                       |
| 1841-42 | 117                           | 4,414                       | 1841-42 | 265                           | 12,523                      |
| TOTAL.  | 1,323                         | 50,172                      | TOTAL.  | 1,939                         | 73,842                      |

4. FISH-ROES, 5. RED FISH and 6. "SARDINES." An account of these condiments will be found under the species used in the preparation, viz.

4. *Alausa toli*, (*Ikan truboh*,) page 1281.

5. *Engraulis brownii*, (*Bunga ayer* or *badah*,) page 1285.

6. { *Dussumieria acuta*, (*Tamban-búlat*,) page 1268.

    { *Clupeonia perforata*, (*Tamban-népis* or *batul*,) page 1276.

7. SHARKS' FINS. The Chinese fishmongers of the Straits Settlements obtain Sharks' fins from the same localities which supply them with Fish-maws. These fins are not exclusively selected from Sharks

(*Squali*), but equally from Rays (*Rajae*). Quantities examined at Pinang were composed of fins of the following Genera: *Stegostoma*, *Carcharias*, *Sphyrna*, *Pristis*, *Rhinobatus*, *Trygon* and *Myliobatis*. Of all fishes Sharks and Rays are the most valuable to the Chinese. The flesh and entrails of all, not even the electric Rays (*Torpedinidæ*) excepted, are eaten either fresh or dried; the skin is used for polishing or converted into shagreen; gelatina is obtained from the larger fins, glue from the smaller. All, except the caudal fins, are cut at the root so as to leave as little flesh as possible. The root is dipped in wetted lime (Chunam) in the erroneous belief of preventing attacks of insects, and then the fins are dried in the sun. Those imported in the Straits Settlements are packed promiscuously in gunny bags, each containing from one half to one Pikul. According to the value in the Chinese market, the fishmongers assort the fins in two kinds: "white" and "black." The white consist exclusively of the dorsal fins, which are on both sides of a uniform light colour, and reputed to yield more gelatina than the other fins. In China the lovers of gelatinous soups pay from 30 to 40 Spanish Dollars per Pikul of white fins. The pectoral, ventral and anal fins pass under the denomination of black fins. The colour, however, varies according to the species from buff to grey or brown, and most of them are of two different colours, the upper surface being dark, the lower light. The black fins, for obvious reasons the most numerous, are supposed to yield a comparatively small quantity of gelatina, and sell in China from 15 to 20 Spanish Dollars per Pikul. Mr. W. T. Lewis has communicated the annexed Table, shewing the quantity of Sharks' fins imported into and exported during 10 years from Pinang to China.

**QUANTITIES OF SHARKS' FINS IMPORTED INTO AND EXPORTED  
FROM PRINCE OF WALES ISLAND, FROM 1832 TO 1842.**

| IMPORT. |                                |                                  | EXPORT. |                                |                                  |
|---------|--------------------------------|----------------------------------|---------|--------------------------------|----------------------------------|
|         | <i>Quantity<br/>in Pikuls.</i> | <i>Value in Sp.<br/>Dollars.</i> |         | <i>Quantity<br/>in Pikuls.</i> | <i>Value in Sp.<br/>Dollars.</i> |
| 1832-33 |                                |                                  | 1832-33 | 40                             | 500                              |
| 1833-34 | 91                             | 977                              | 1833-34 | 308                            | 4,927                            |
| 1834-35 | 79                             | 893                              | 1834-35 | 408                            | 4,770                            |
| 1835-36 | 27                             | 350                              | 1835-36 | 267                            | 3,817                            |
| 1836-37 | 129                            | 1,287                            | 1836-37 | 329                            | 5,699                            |
| 1837-38 | 60                             | 966                              | 1837-38 | 195                            | 4,432                            |
| 1838-39 | 195                            | 3,001                            | 1838-39 | 426                            | 5,451                            |
| 1839-40 | 76                             | 1,703                            | 1839-40 | 319                            | 5,970                            |
| 1840-41 | 172                            | 2,582                            | 1840-41 | 360                            | 4,689                            |
| 1841-42 | 521                            | 7,457                            | 1841-42 | 525                            | 7,781                            |
| TOTAL,  | 1,350                          | 19,216                           | TOTAL,  | 3,177                          | 48,036                           |

8. **BALÁCHAN**, is a condiment prepared from small fishes of all descriptions and shell-fish. The ingredients are placed in a pit to undergo fermentation, and afterwards dried, pounded, and preserved with spices. With the Malays, Siamese, Burmese and Cochin-Chinese, Baláchan has become a necessary of life, as it serves to season the daily food of these nations.

9. **FISH-MANURE**. The smallest fishes, and all offal are employed in the spice plantations by the Chinese gardeners and agriculturists of Pinang, who consider the fluid in which fishes have been salted a very useful manure in cocoanut plantations.

10. In addition to the preceding, there are two animal productions of the eastern seas, which also are considered fishes by the Chinese. They are the dried *Holothurioidæ*, called *Tripang swala* or *Becke de*

mar, and *Cuttle Fishes*. Of both large quantities are annually collected and dried for the market in China.

The naked Cephalopods are not only eaten fresh, but one species, a *Loligo*, forms in its dried state a considerable article of traffic. The preparation consists in removing the inkbag without laying open the mantle. After all impurities have been removed by water, the mollusc is submitted to a slight pressure, and ultimately exposed to the sun. Small bundles of one Katty's weight are tied up with slips of ratan, and enclosed in cases holding 10 Katties and upwards. The Pikul sells at the rate of 14 to 16 Spanish Dollars.

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\* In the following Catalogue have been admitted the names of such of the *Illustrations* only of which descriptions have been published. Genera and species founded on these figures alone have in several instances originated errors.



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### BUCHANAN HAMILTON'S ICHTHYOLOGICAL DRAWINGS.

They consist of 144 coloured figures of fishes executed by native painters, and they form a portion of the series of Zoological Drawings\* which on Buchanan Hamilton's departure from India were deposited in the Library of the Honorable Company's Botanic Gardens, Calcutta. In the valuable Report on the Calcutta Botanic Garden Mr. Griffith has given the following account of these Drawings: "Coloured Drawings of Dr. Buchanan, (afterwards Hamilton,) stated to have been deposited in the Library in 1815.

|                  |     |
|------------------|-----|
| Fishes, .....    | 144 |
| Reptiles, .....  | 19  |
| Birds, .....     | 349 |
| Quadrupeds,..... | 36  |

For many of the originals copies appear to have been substituted. There are in addition 18 folio sheets containing copies of some of the drawings of Fish, executed apparently in Dr. Wallich's time. Of Birds, &c. there are also similar duplicate copies 22; and of unfinished and un-named 14." (*William Griffith : Report on the Hon'ble Company's Botanic Gardens. Printed by Authority. Calcutta, 1843. Part V. Library Department, page 96.*)

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\* In the preface to the fourth volume of *Histoire Naturelle des Poissons*, (Paris, 1829,) the authors acknowledge their having, through Dr. Horsfield, had access to a series of Buchanan Hamilton's Ichthyological Drawings in the Library of the East India House, London.

Mr. Griffith while superintending the Botanic Gardens transferred these drawings to the Library of the Asiatic Society, Bengal. To nearly every Drawing of the Fishes Buchanan Hamilton has in his own hand-writing attached a systematic or vernacular name under which most of the species were subsequently published in his Work upon the Fishes of the Ganges. This is the series of Buchanan Hamilton's Zoological Drawings, which Mr. McClelland complains of having been kept closed from public view in the Botanic Gardens, Calcutta, from 1815 to 1838, during twenty-two years subsequent to Buchanan's departure from India. Years have elapsed, and no explanation has been offered to Mr. McClelland's just observations: "Had such an injury to the advancement of information resulted from an oversight in an ordinary public office, the circumstance would excite less surprise; but that the works of naturalists should be so treated in a public Institution expressly intended for the promotion of science, is so unaccountable to me, that I cannot presume to express an opinion on the subject. But as the case stands, perhaps the best remedy that can now be applied in justice to Buchanan, as well as to others who are still engaged in scientific pursuits, would be to give a complete edition of his labours, botanical and zoological, to the public; at the same time it is right to say that no atonement can now make amends for the injury that has been inflicted on Buchanan as a naturalist, or for the time that has been lost in allowing others to go over unnecessarily the ground which he investigated, instead of beginning where he left off." (*Asiatic Researches*, Vol. XIX. Second Part, page 223. Calcutta, 1839.)

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